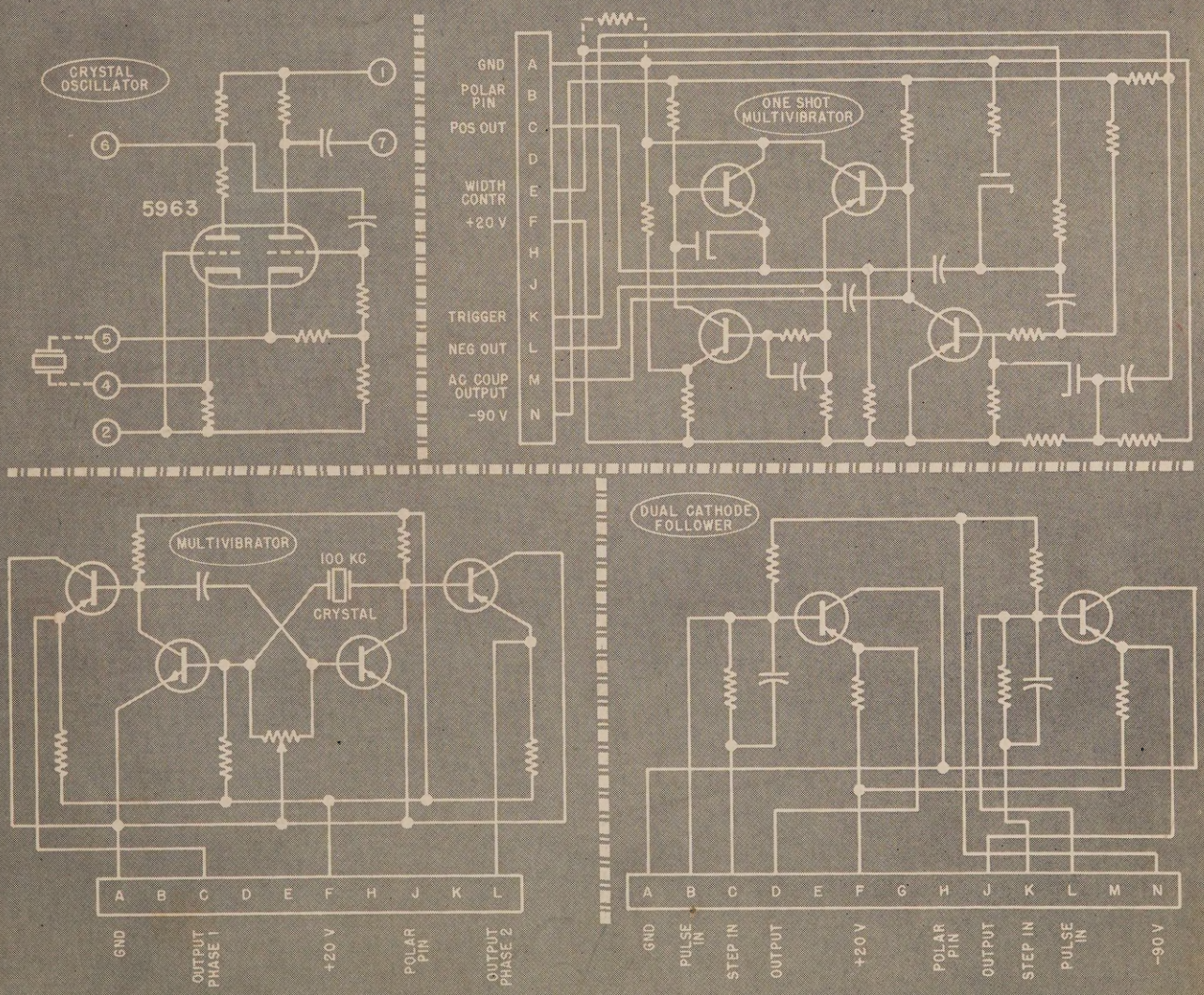
SEPTEMBER, 1957

MINIATURIZED CIRCUITRY

SERVICE

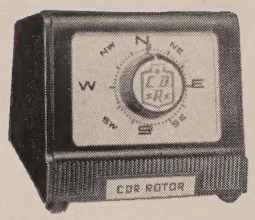
THE TECHNICAL JOURNAL OF THE TELEVISION-RADIO TRADE



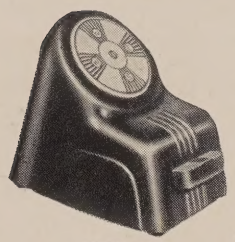
Miniaturized tube and semiconductor circuitry now being used in industrial-electronic systems, basically similar to current circuitry in TV chassis and test equipment.

See circuit analyses, this issue

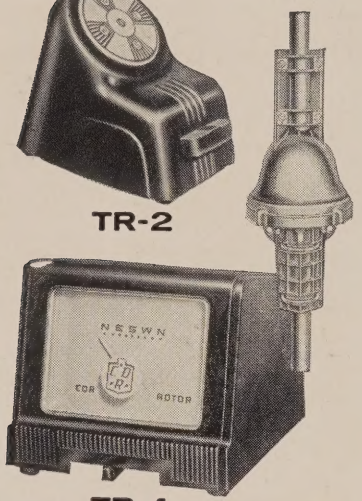
2-60



AR-22



TR-2



TR-4

5-star feature...

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the growth of color TV means an even greater demand for CDR Rotors for pin-point accuracy of antenna direction.

2 a better picture on more stations

CDR Rotors add to the pleasure of TV viewing because they line up the antenna perfectly with the transmitted TV signal giving a BETTER picture . . . and making it possible to bring in MORE stations.

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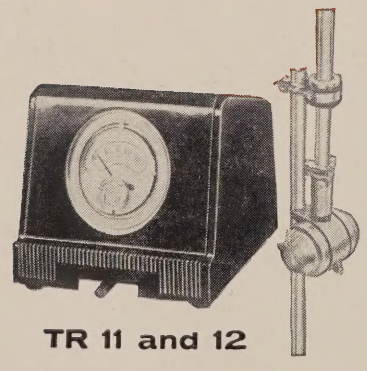
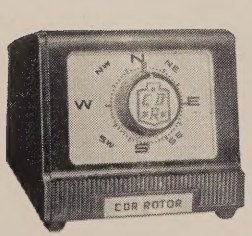
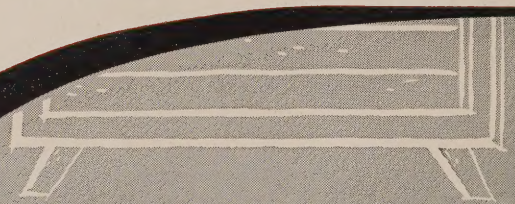


TR 11 and 12



AR 1 and 2



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5 the complete line

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Vol. 26 No. 9 SEPTEMBER, 1957

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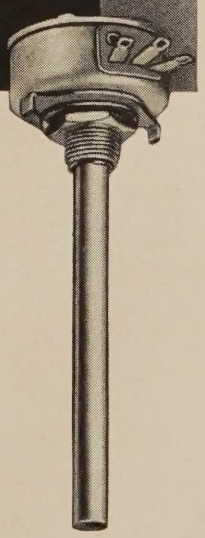

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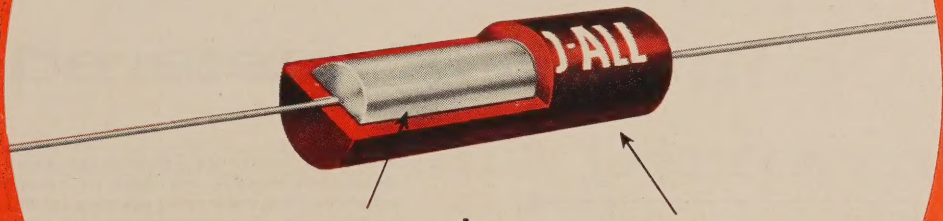

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Sylvania TV Tuner Tubes

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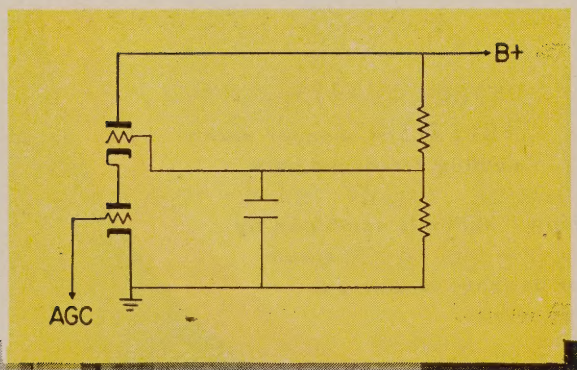

Simplified schematic is a typical cascode circuit in which double-triode amplifiers are tested for transconductance and plate current under actual operating conditions. In this way, Sylvania offers you maximum assurance of proper circuit performance when you repair TV tuners. Regardless of make or model TV, Sylvania tuner tubes mean dependability backed by industry's most exhaustive dynamic testing program.

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200 mc for controlled, dependable performance

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RATINGS AND SPECIFICATIONS

	Recommended Design Center	Absolute Maximum
RMS Input Voltage	117	130 volts
Peak Inverse Voltage	340	380 volts
D-C Output Current	200-400	400 ma
Rectifier Full Load Voltage Drop*	0.28	0.30 volts
Series Surge Resistor	4	4 (min) ohms
Ambient Operating Temperature	40	55°C
Operating Fin Temperature	50	65°C

**Full Cycle Average*

This represents General Electric's latest addition to its priced-right line of *snap-in* replacement TV rectifiers. Other easy-installation G-E TV rectifiers include the 1N1005 (250ma), 1N1007 (350ma), and 1N1013 (250ma). In most cases, the G-E snap-in design permits installation in the same chassis hole used for the selenium stud or bolt.

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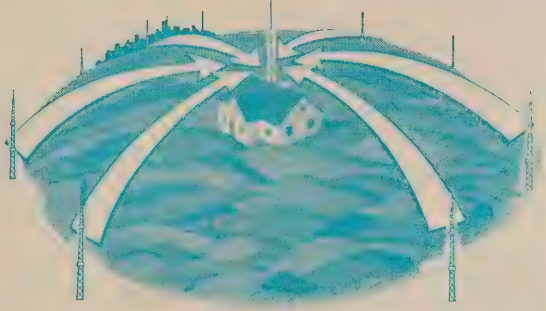

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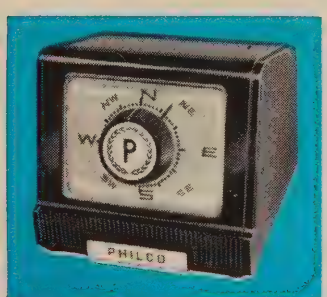

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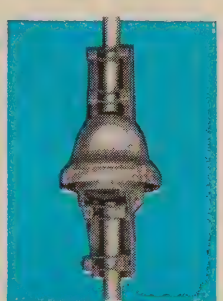
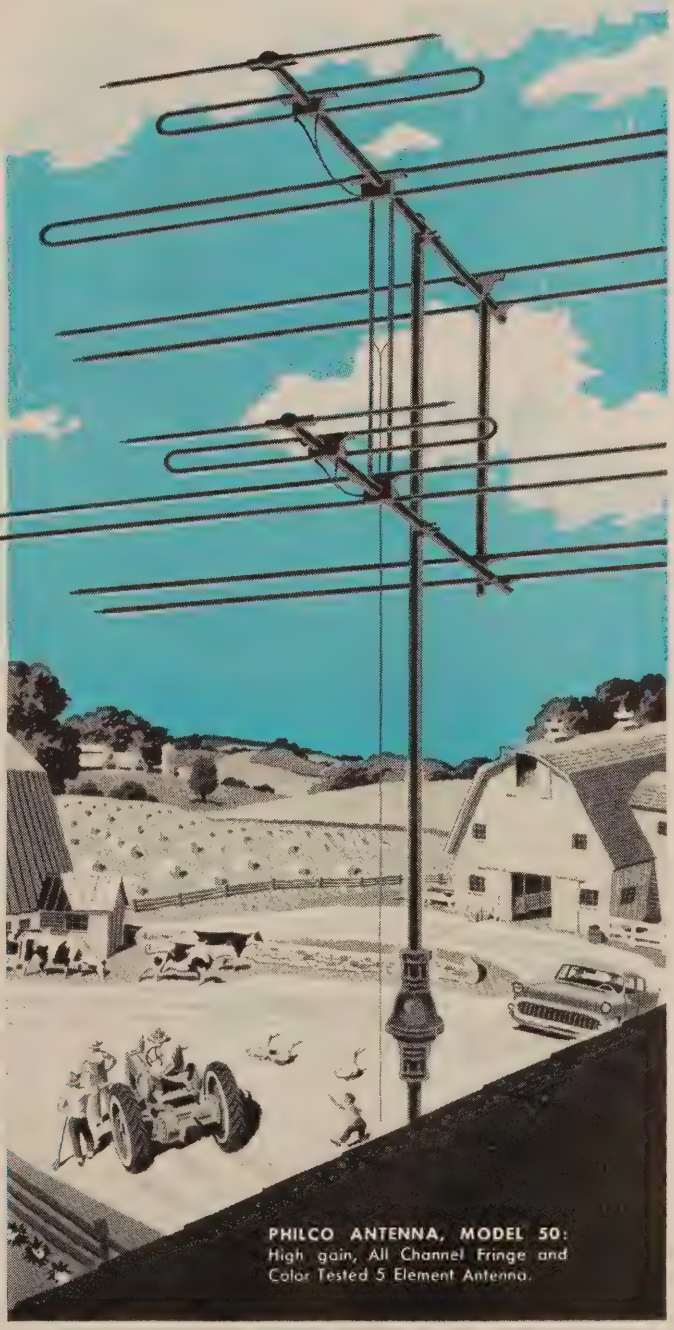


AP22 Rotor: Weather-tested and proven for long service-free life. Designed by service-experienced engineers to highest quality standards.



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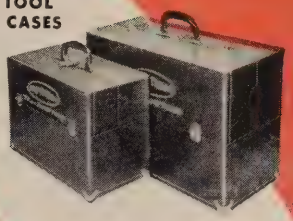
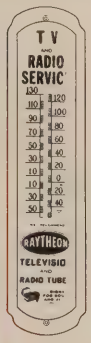


OUTDOOR THERMOMETER



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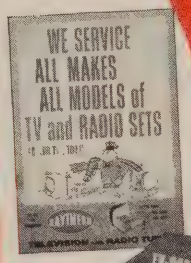

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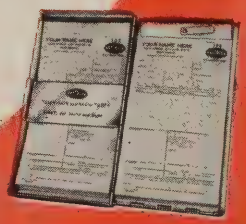

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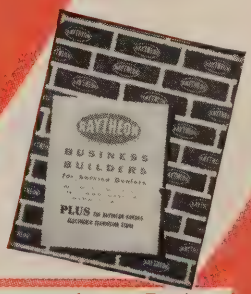
POCKET CASE



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The Trend To Miniaturization

INDUSTRY PROGRESS of an ever-increasing magnitude is now being recorded on an ever-widening front. Heightened pressure for improvements and new developments in home and industrial equipment has sparked this unparalleled activity, which has shortened the time steps between research, design and production.

One of the outstanding results of this accelerated drive for advancements has been the development of new types of extremely efficient miniaturized components, accessories, tubes, semiconductors and streamlined circuitry, permitting unusual applications in consumer and, particularly, commercial chassis and systems.

THANKS TO MINIATURIZATION, it is now possible to build compact equipment with high performance values. The smaller — yet more sensitive — radio and TV sets and phonos, too, underscore this fact. And the variety of miniaturized industrial-electronic devices, now available for an increasing number of services, offer further solid testimony to the import of the trend.

THE MOVE TO MINIATURIZATION is of particular concern to all Service Men—those who repair home sets and especially the growing number now responsible for the installation, repair and maintenance of miniaturized commercial equipment in the plant or in the service shop.

IN THE INDUSTRIAL-ELECTRONIC field, miniaturization will be found not only in the computer, but in control systems, intercoms, closed-circuit TV, timing networks, two-way chains and many test operations.

One type of miniaturized commercial intercom which has become very popular is the auto-dial system designed to curb desk absenteeism, the bane of office and production efficiency. In a recent installation, a 12-building plant was honeycombed by the intercom network to enable processing and production people to obtain without delay, and without leaving their desks, up-to-minute reports on processing factors. Heretofore, it was necessary to obtain such information by intra-building trips, by lung power, or by trying to get internal phone calls through an over-taxed switchboard.

IN ANOTHER INDUSTRIAL MINIATURIZED development, we have an electronic trigger, which provides eight separate pulse outputs in sequence—ideal for radar. With this trigger, a radar transmitter can be pre-started with an adjustable time interval so that the transmitted *rf* pulse, which picks up the target on the radar 'scope, will occur at the exact start of the indicator sweep to minimize error in range measurements.

In telemetering systems we have still another important application of miniaturized equipment. With one network, recently installed, it is now possible to obtain information on an almost limitless array of flight functions and conditions including pitch rates, altitude, acceleration, stresses, temperatures, functioning of control surfaces and servo systems, radio-control responses and monitoring of computers.

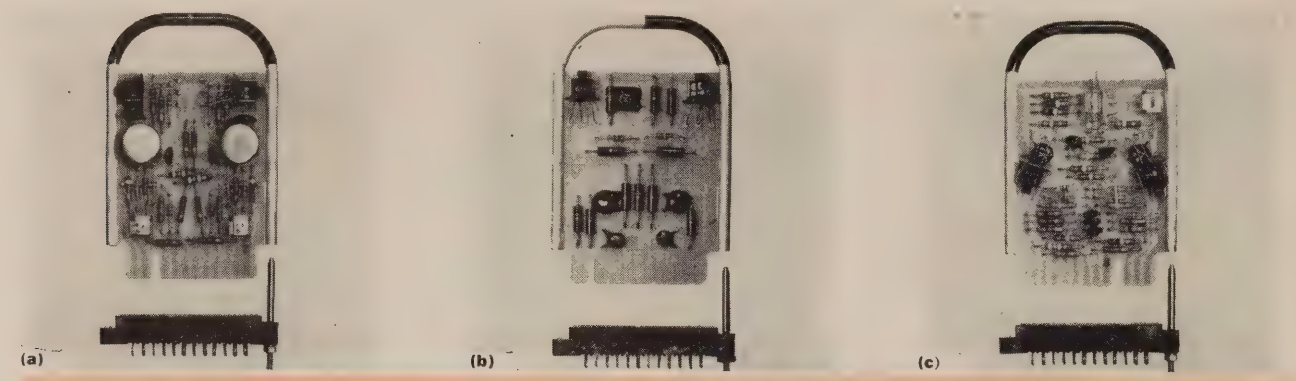
Notwithstanding the specialized and complete services these industrial-electronic designs afford, the circuits used are not involved and are basically familiar to the Service Man. To illustrate, in the foregoing telemetering system, voltage variations are supplied to a modulator tube which varies the frequency of a subcarrier oscillator operating in accordance with flight-instrument indications. Several FM audio sub-carriers are employed for this purpose and their mixed outputs are used to frequency modulate a *vhf* transmitter. This composite signal is received by an FM receiver which employs several filters and discriminator units tuned to subcarrier channel frequencies.

IN COMPUTERS, we also find circuit similarities. Here we have miniaturized multivibrators and cathode-follower circuits whose counterparts in TV and test equipment appear as sweep oscillators, electron switches and signal-generator outputs.

MINIATURIZATION has paved the way for an ever-growing list of important component and circuit contributions.

An exclusive report on the progress achieved by this new major industry activity, including complete analyses of miniaturized circuitry developed for home and industry, appears in this issue, beginning on page 12.

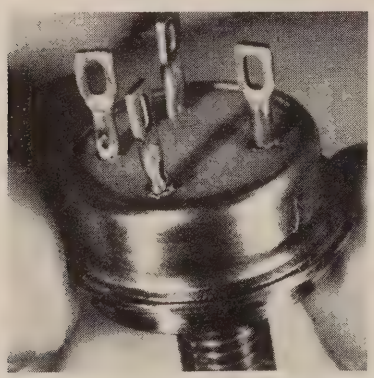
FIG. 1 (below): **MINIATURIZED PLUG-IN** semiconductor printed-wiring boards designed to serve as pulse amplifier (a), inverter amplifier (b) and (c) flip-flop in computer and control-type equipment.



A Field Report on

Latest Developments In Circuits Accessories, Tubes, And Semiconductors

FIG. 2: NEWEST TYPES of transistors available for electronic control and computing equipment. Transistor below, a power tetrode (Minneapolis-Honeywell), can be used to operate on a 28-volt system with currents up to 10 amperes.



THE TREND TO MINIATURIZED CIRCUITS involving the use of extremely small components, assemblies, semiconductors and tubes, has developed entirely new concepts in installation, repair and maintenance, especially for industrial electronic equipment; a situation of particular concern to the growing number of Service Men now active in this field in plants and as independents using their own shop facilities.

Because of the complexity of most electronic systems, designers have resorted to the use of *packages* or *plug-in* units, where each unit is a circuit complete by itself, except for input, output and the power source.

The majority of these packages usually use printed-circuits with semiconductors, although subminiature tubes are still being used in some electronic control and computing equipment chassis.

These circuits, like those found in radio and TV receivers, use printed wiring boards, which are fixed in place. In control or computing equipment the boards are provided with strip connectors, so that they can be easily changed during servicing. Since control electronic apparatus use many boards, the plug-in technique permits rapid repair and maintenance.

In addition to active elements the boards have, of course, other components. These may be single parts modified to fit the holes on the board, or in some cases the components are themselves small boards, as illustrated in Fig. 3 and Fig. 3A. Here, both resistors and capacitors are the building blocks that are but ⅛″ in diameter and ⅝″ long. These are stacked on a small board with embossed wiring. This board plugs into a larger board which, in turn, plugs into the final equipment.

Also available are *rc* networks; small ceramic *boards* with resistors

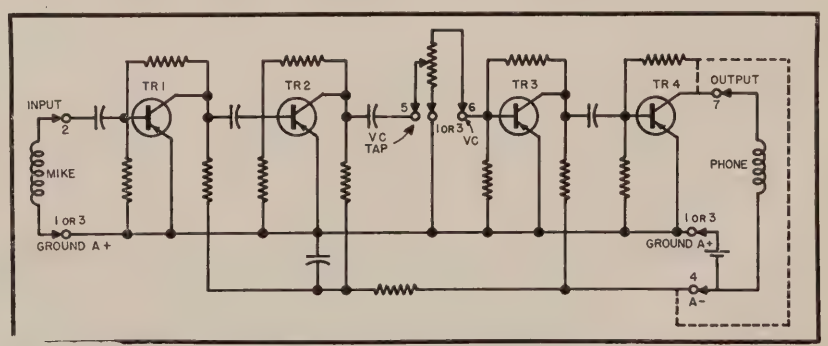
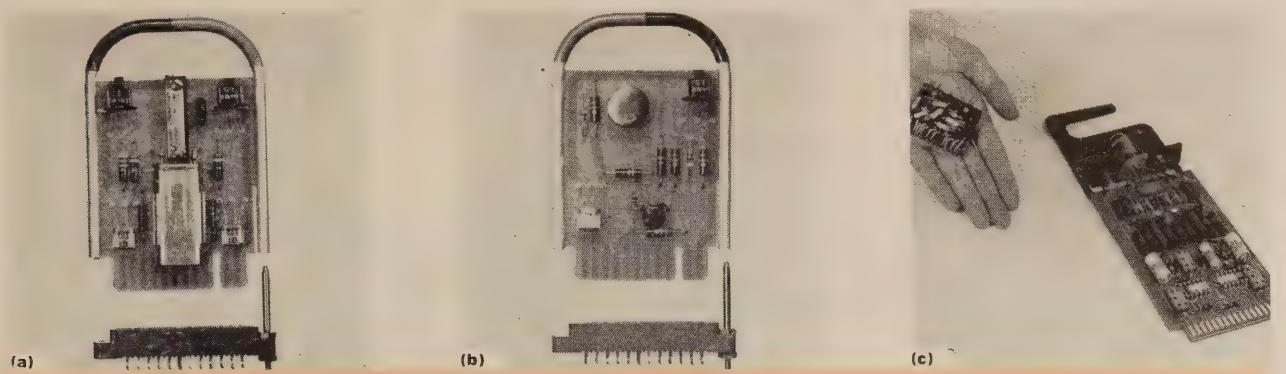


FIG. 3 (left—above): PACKAGED MINIATURE COMPONENT-CIRCUIT assembly. At left is a packaged 4-stage transistor amplifier, supplied complete with transistors, resistors, capicitors and wiring, which can be used in hearing aids, pocket-size radios, or as a preamp or amp. Circuit of this assembly is above. (CRL)

FIG. 1A (below): ADDITIONAL TYPES of miniaturized plug-in semiconductor p-w boards. In (a) is a crystal-controlled oscillator; (b) variable-frequency oscillator and (c) a computer-switching assembly. Tiny unit of recent design (c) in palm of hand at left performs same job as larger board at right built nearly five years ago. (Photos at left and below Courtesy Computer Control and Sylvania)



Miniaturized Circuitry*

[See Front Cover]

Designed for Miniaturized Components, Including Transistors And Diodes

and capacitors built-in on the base material.

While these packaged circuits look different than those used in radio and TV receivers they are, in fact, very closely related to circuits familiar to most Service Men.

This point is illustrated in the circuits shown in Figs. 6 and 7; page 16.

Crystal Oscillator

A crystal oscillator, for applications requiring an accurate frequency in the range from 90 to 250 kc, is diagrammed in Fig. 6a (p. 16). This circuit oscillates at the series resonant point of the external crystal, thereby providing a non-critical, low-impedance input connection for the external crystal.

Other familiar uses for a similar circuit are as a local oscillator in a communications receiver (perhaps with frequency multipliers to increase the signal frequency) or as an *rf* signal source in a signal generator or a marker generator. This is a good example of a well-known circuit with many new applications as a plug-in package.

AF Signal Oscillator

Another type of oscillator, such as is used as an audio-frequency signal source, is the *rc* or phase-shift oscillator shown in Fig. 6b (p. 16)‡.

Three external variable resistors are needed; their values determine the frequency range. A three-section 500,000-ohm potentiometer provides

(*Continued on page* 16)

Based in part on data supplied by **Allan Lytel, Supervisor Technical Information, General Electric, and **G. J. Prom** and **R. L. Crosby**, Waltham Laboratories, Sylvania.*

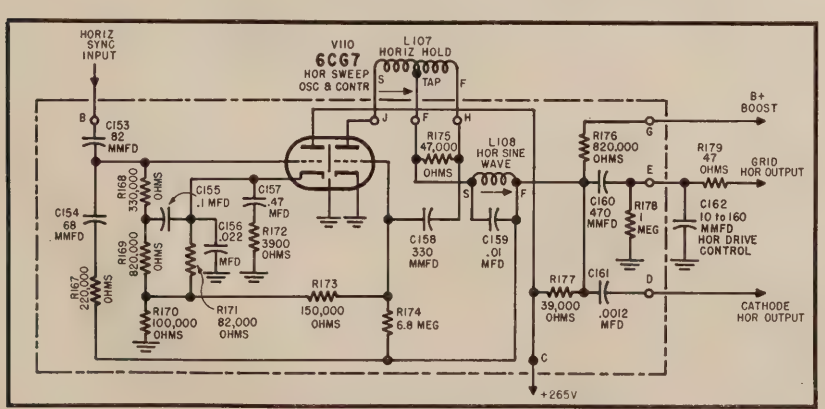
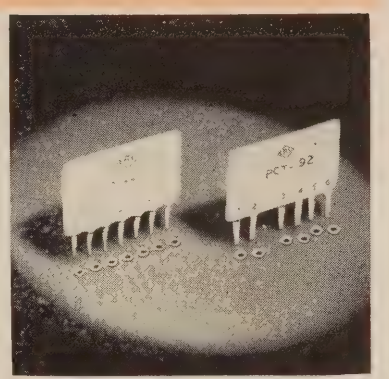
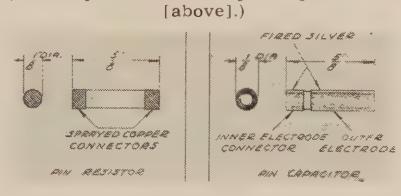


FIG. 5: CIRCUITRY OF MINIATURE PACKAGED TV horizontal oscillator and horizontal oscillator control used in RCA KCS94 chassis.



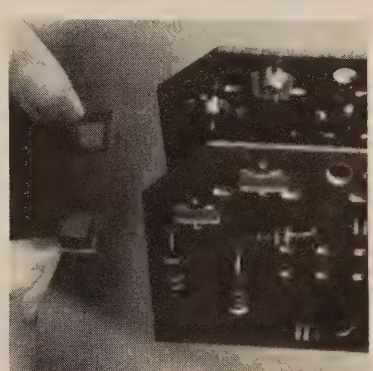
(Above-below)

FIG. 3A: MINIATURE RESISTOR-CAPACITOR assemblies. In these assemblies the resistors and capacitors represent building blocks which are stacked on small boards with plated wiring. (Courtesy Erie Resistor [below] and CRL [above].)



(Below)

FIG. 4: R-C NETWORK type components; ceramic boards with parts built in on the base material. In processing these assemblies, capacitors are inserted either manually or by placement machines in slots in the p-w board, and then bonded to the connection point by dip soldering. (G.E.)



PROFESSIONAL RECOGNITION, GENERAL ELECTRIC ALL-AMERICAN

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General Electric proudly establishes the All-American Awards to honor the TV Service Technicians of America for their good citizenship in many fields of public service.

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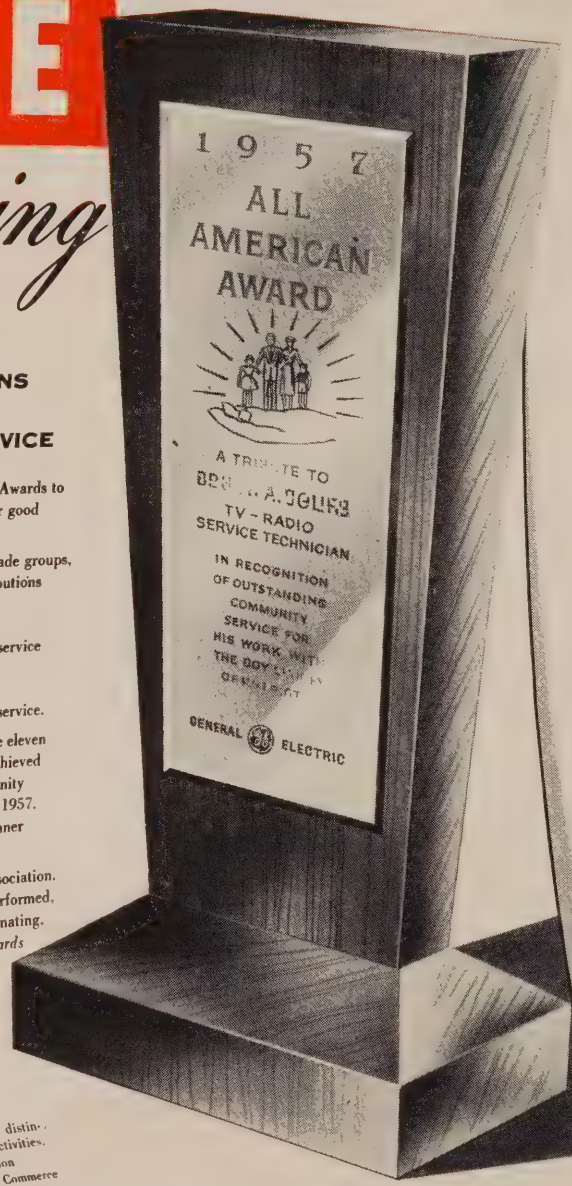
General Electric Co., Receiving Tube Department, Owensboro, Ky.



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Easel-back display, "Football Time Is TV Tune-up Time"... Large football-theme window banner... Eye-catching window streamers... Special direct-mail folder and postcard...Newspaper mats... "Set-owners' TV Service Guide", a business-building booklet to give to service prospects.

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FOOTBALL IS HERE. The star-studded entertainment programs are back. Millions of TV owners need to have their sets checked for top performance. Timed for this fall market, General Electric has kicked off its All-American campaign in support of the TV-service profession—the biggest ever—to 25,000,000 readers of LIFE. Full-page ads feature the all-around job service dealers like yourself are doing in and for the community...point to shops like yours as neighborhood TV-radio service headquarters.

To assist you further as an independent TV technician...to help identify your shop as first choice for tune-up work...General Electric has ready for you, through your G-E tube distributor, a new, timely kit of displays and advertising aids that will catch the eye of football fans and other set-owners who want tune-ups and repairs.

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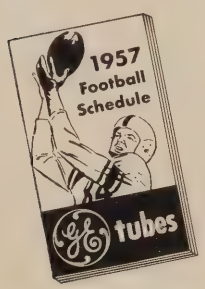
Phone your G-E tube distributor! Ask him how you can tie in *now* with this big General Electric fall campaign to strengthen your community standing, and underscore your reputation for service! *Distributor Sales, Electronic Components Division, General Electric Company, Owensboro, Ky.*



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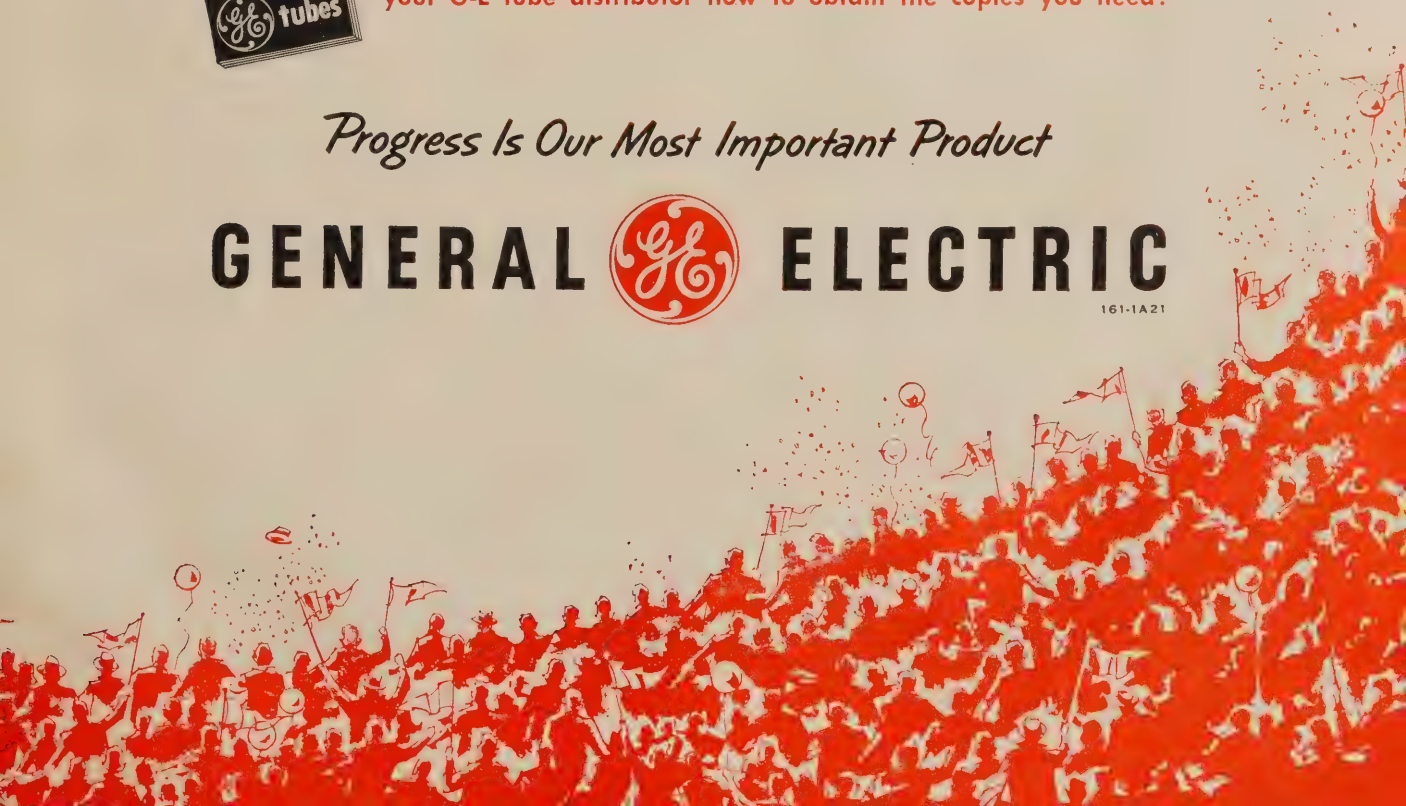
161-1A21



Report on Miniaturized Circuitry

(*Continued from page* 13)

a frequency range of from 175 to 500 cps.

Three *rc* legs, in the feedback path from plate *1* to grid *2*, provide about 60° for a total of 180° required for oscillation.

Both of these oscillators may be used to provide *clock* or synchronizing signals for a computer or control system.

A general-purpose push-pull *rc*-coupled amplifier, with so many applications that it is found in almost all types of electronic equipment, is shown in Fig. 7*a*. The Fig. 7*b* diagram is a squaring circuit designed to convert sine or complex waveforms of frequencies between 0 and 100 kc into square or rectangular waves of standard amplitude and rise and decay times. The grid-leak resistor for the input section is brought out to pin *4* so that input sensitivity and output wave shape symmetry may be adjusted according to the specific application.

A circuit like this will be found in test equipment such as a square-wave generator or an electronic switch.

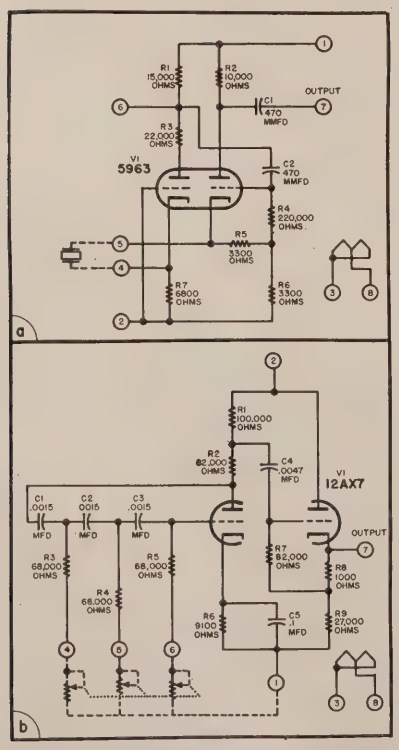


FIG. 6: MINIATURE CIRCUIT packages using subminiature tubes. In (a) is a crystal oscillator, and in (b) we have a phase shift oscillator. (Courtesy Engineered Electronics)

Circuit packages with transistors, as in Figs. 3A and 8, are becoming increasingly significant in home and industrial-electronic equipment.* The Fig. 8 circuit is that of a one-shot multivibrator which uses collector-coupling with four high current-gain *pnp* transistors (GT-122) with both a positive and negative pulse output for each signal trigger input.

Transistor Characteristics

The grown junction germanium transistor, the first high-frequency type to become available, was not found to be too suitable for computer and control equipment. Although switching circuits could be designed around this transistor type, other types such as the alloy, diffusion, and surface-barrier transistors were found to be better suited for this application because they exhibit low and consistent values of extrinsic resistances[1]. Since reliability is the most important factor in the design of these circuits, the lowest possible supply voltages have been selected, consistent with the output requirements. The full load flip-flop output or enable voltage is about 5.5 volts, and the amplitude of the standard .3 microsecond pulse is 4 volts biased at −1.5 volts. These amplitudes are approximately double the minimum required drive levels. Although only three supply voltages are required, the circuits

(*Continued on page* 18)

‡The frequency of operation is given by the following formula, when all three legs of the feedback network are equal:

$$f_{cps} = \frac{1}{2\pi\sqrt{6}\,RC}$$

where R = Total resistance in one leg, including fixed resistor (R_2, R_4, or R_5) and one section of external potentiometer.
$C = C_1$, C_2, or C_3.

*Allen Lytel, ***Semiconductor Circuit Developments***, SERVICE; *April*, 1957.

[1]The extrinsic base resistance of r_b' and the extrinsic collector resistance r_c' are of particular importance. A large value of r_b' limits the response time of the collector current to an increment of base voltage; a large value of r_c' limits the circuit efficiency and complicates the circuit design problem.

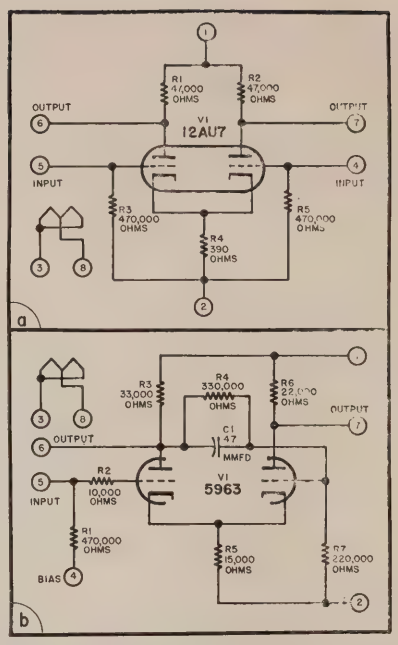


FIG. 7: TWO MORE MINIATURE circuit assemblies for use as a push-pull voltage amplifier (a) and 0 to 100-kc squaring (b). (Courtesy Engineered Electronics)

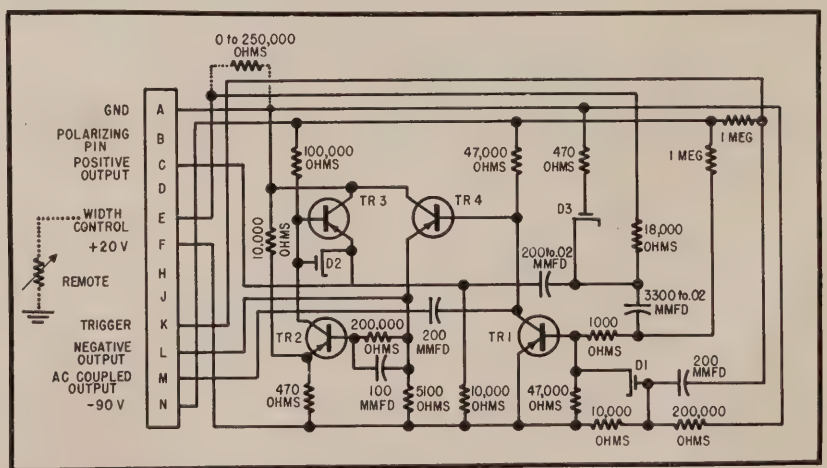
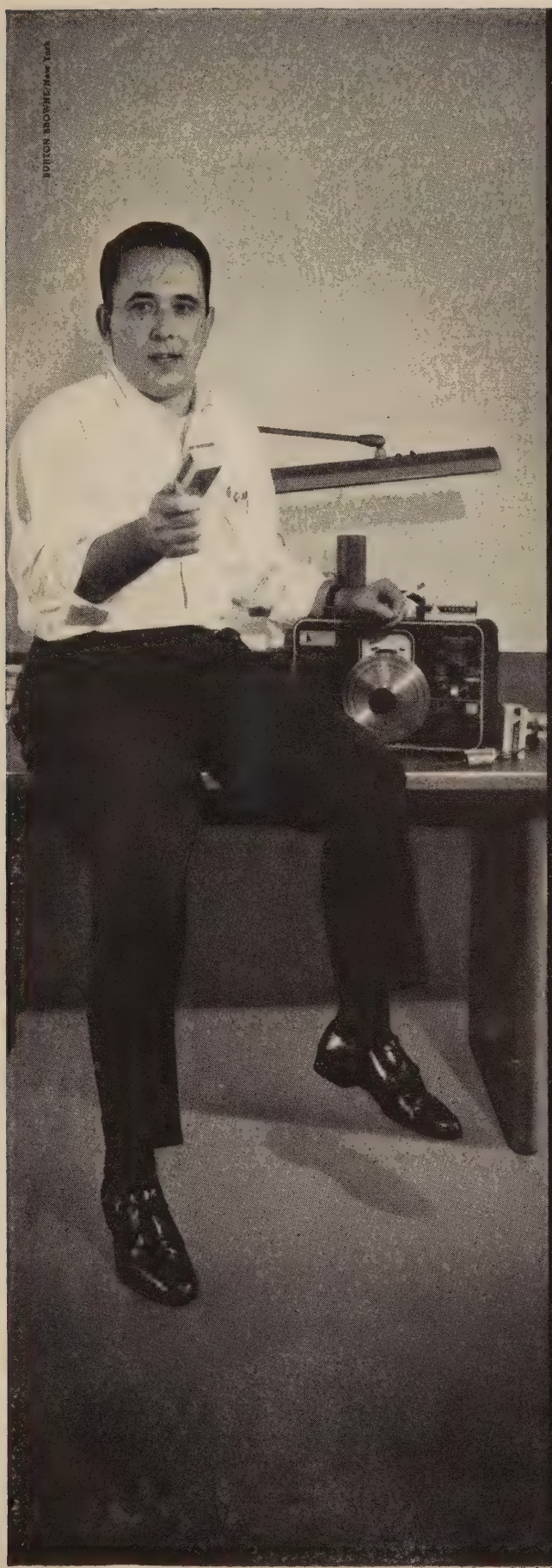


FIG. 8: TRANSISTORIZED MULTIVIBRATOR with four high current-gain pnp transistors (GT-122). Diodes are 1N28 types. (Courtesy Computer Control)



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Report on Miniaturized Circuitry

(*Continued from page 16*)

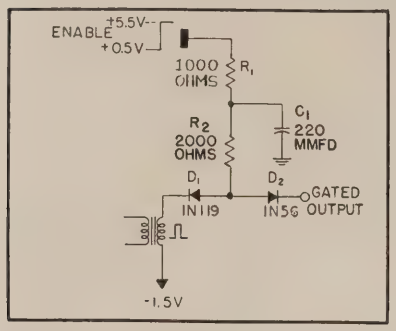


FIG. 9: TRANSISTOR DIODE-GATE circuit found in computers to detect coincidence between flip-flop output and a train of clock pulses.

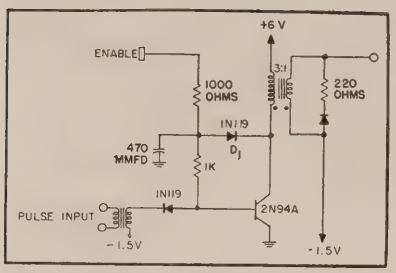


FIG. 10: GATED-PULSE AMPLIFIER, a modification of the diode-gate circuit, in which the output diode has been replaced by a transistor amplifier providing a total current gain of about ten.

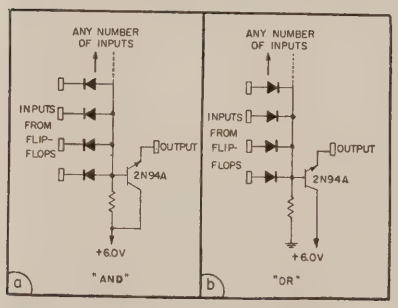
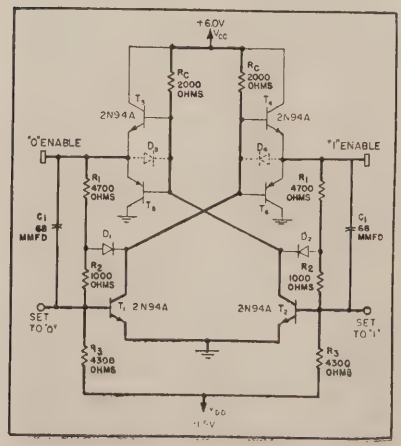


FIG. 11: SCHEMATIC of dc and gating circuits which can be used to gate two or more flip-flop circuits.



have been designed to withstand voltage variations of at least ±40%.

Other factors contributing to the operational reliability of these circuits are 20° *C* safety margins at both ends of the operating temperature range and the liberal use of emitter followers and transformer-coupled pulse amplifiers to provide proper impedance-matching.

Diode Gate

The most common gating requirement in a computer employing static logic is to detect coincidence between a flip-flop output and a train of clock pulses. A schematic of the diode gate which performs this function appears in Fig. 9. A high level (5.5 to 6 volts) from the flip-flop enables the gate, causing a current of about two milliamperes to flow through R_1, R_2, D_1, and the transformer secondary winding. Thus, diode D_1 is conducting, and D_2 is cut off. If a positive pulse is then applied across the transformer secondary winding, diode D_1 is cut off and D_2 conducts, allowing the gated current to flow in the load circuit. A low level (.2 to .8 volt) from the flip-flop effectively removes the current supply, thereby disabling the gate.

The capacitor C_1 supplies the gate with a short memory so that the gating action is complete before flip-flop transients can effect the result.

The transformer secondary winding may be common to many gating and pulse amplifier circuits as long as the *dc* voltage drop across the winding does not approach 1.5 volts.

A desirable feature of this gating circuit is that it is relatively insensitive to input pulse level variations. Assuming a constant enable voltage, any input pulse amplitude greater than two volts will result in a constant output current.

Gated Pulse Amplifier

A modification of the diode gate circuit, the gated pulse amplifier, is shown in Fig. 10. The output diode

(*Continued on page 56*)

(Left)

FIG. 12: CIRCUITRY of flip-flop circuit; heavy lines indicate Eccles-Jordan configuration. This circuit is used to provide rapid switching in a computer system. (Figs. 9-13, Courtesy Sylvania)

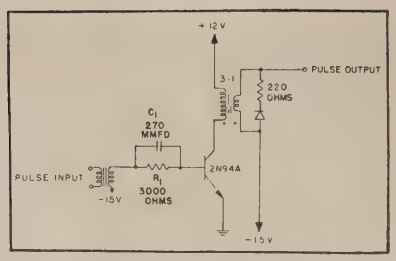


FIG. 13: PULSE AMPLIFIER circuit designed to provide an output current of about 60 ma. A current of this magnitude is often required when a large number of flip-flops and gates must be driven by a single source.

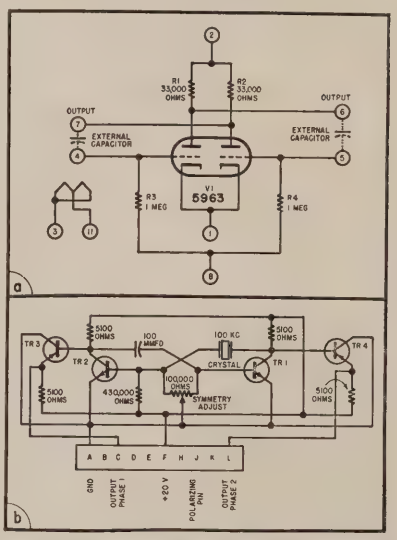


FIG. 14: SCHEMATICS OF MINIATURE tube and semiconductor multivibrators. Circuit in (a) can generate square or rectangular wave outputs at rates up to 100 kc. The (b) transistor setup is a crystal-locked multivibrator whose outputs differ by 180°. (Courtesy Engineered Electronics [a] and Computer Control [b])

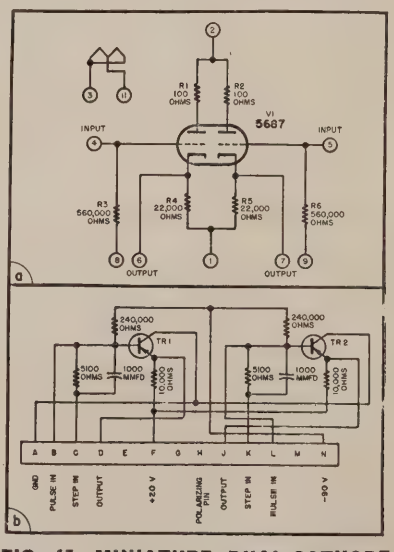


FIG. 15: MINIATURE DUAL-CATHODE follower circuits using tubes (a) and transistors (b). (Courtesy Engineered Electronics [a] and Computer Control [b])

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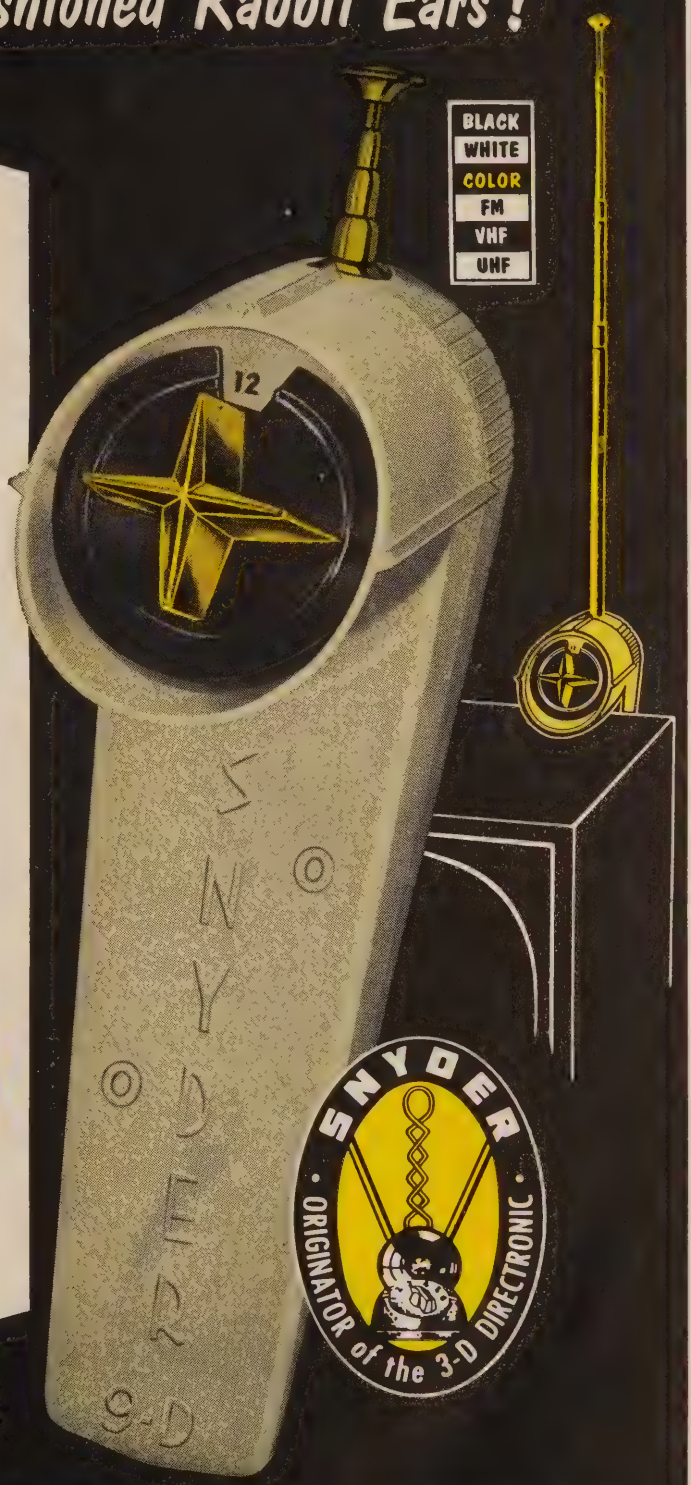

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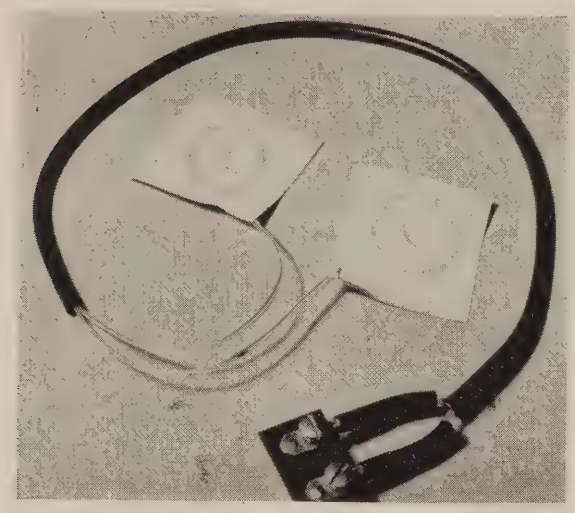


by S. WLASUK

TV Engineering Department, Consumer Products Division

RCA Service Company, Inc.

LEFT

TWO-COIL UNIT designed to provide blanking of horizontal return retrace.

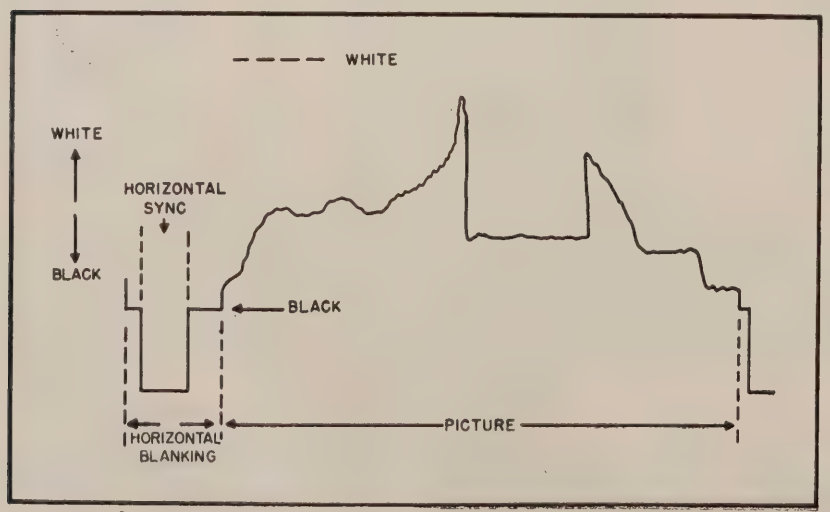
OF THE VARIOUS TV picture difficulties, the problems occuring during horizontal retrace time are probably the most difficult to diagnose and correct.

One of the problems connected with horizontal retrace can be best described by referring to Figs. 1 and 2. It will be noticed that the normal start of retrace occurs at the leading edge of the sync pulse. Some receivers delay the start of sync before applying it to the horizontal frequency control circuits. The delay usually occurs in the sync separators or amplifiers, but can occur in any part of the signal path between the *rf* unit and the grid of the horizontal output tube. The delay of this pulse would tend to move the start of retrace to point *A*. Since the time necessary for retrace is fixed by the circuit components of the horizontal scan circuit, the end of retrace with a delayed sync input would now move to point *B*. Some receivers, too, have, inherently, an extremely long retrace time which would move the end of retrace to point *C*, when the long retrace circuit is combined with a sync pulse delay. Point *C* moves into the area of picture information and creates an undesirable condition where the picture information starts before the scan circuits ever start tracing a horizontal line from left to right. Picture *fold-over* is the name applied to this condition; the *fold-over*, of course, occurring on the left side of the picture.

The problems to be solved in this case are excessive sync lag and excessive retrace time. The correction of either one can be a little difficult, as many will agree.

Another problem connected with horizontal retrace is illustrated in Fig. 3.

In an effort to sharpen the picture for more pleasing viewing, some receiver circuits are found to overpeak the video before applying it to the picture tube. This overpeaking causes a certain amount of overshooting on fast rise pulses like the horizontal sync pulse. Again, an unwanted condition is created, where the retracing



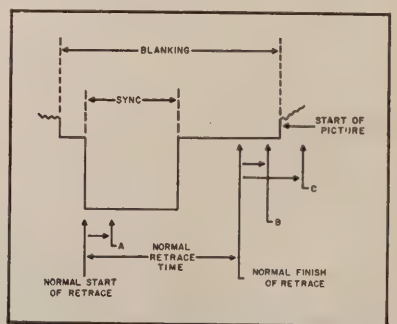
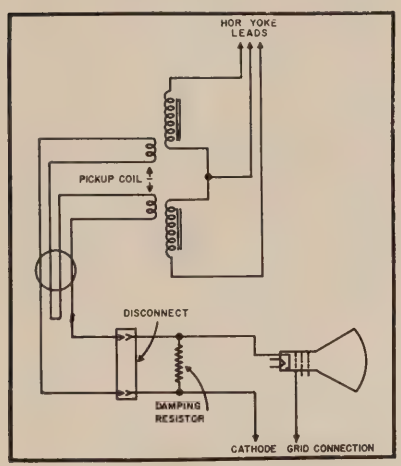


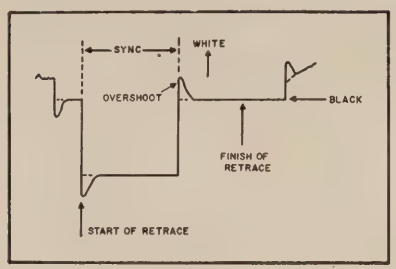
FIG. 1 (left): IDEAL WAVEFORM of voltage present on the grid of the picture tube during a typical horizontal line.

FIG. 2 (above): ENLARGED VIEW of Fig. 1, detailing fact that the normal start of retrace occurs at leading edge of the sync pulse.

Problems and Solutions

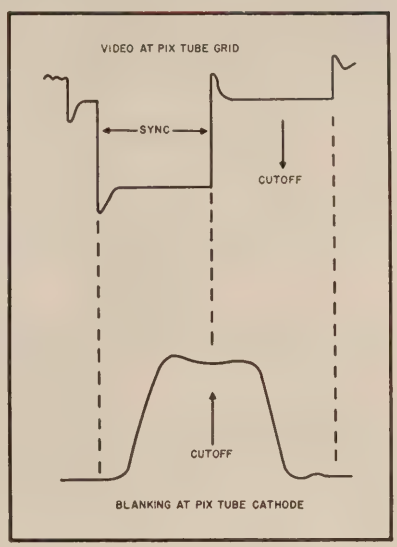
Overpeaking And Spray From Horizontal Scan Circuits





(Above)

FIG. 3: COMMON PROBLEM found with TV chassis in some locations. The addition of all of the horizontal lines, each with a sync overshoot, develops a fuzzy rope-like line running vertically down the picture near the horizontal center.



FIGS. 4 (above) 5 (right): SYSTEM devised to blank the picture into cutoff during retrace by using a sample of the yoke power required to scan for the control voltage on either the grid or cathode of the picture tube is shown in Fig. 4. Video wave forms present on the grid and cathode leads of the picture tube appear in Fig. 5.

beam is not held to black over its entire period. The addition of all the horizontal lines, each with a sync overshoot, would give a fuzzy, rope-like line running vertically down the picture near the horizontal center. The remedy for this trouble is difficult since, in most cases, some reworking of the peaking circuits is necessary.

Another problem that affects retrace is often mistaken for overshoot, but in reality is entirely different in nature, and consists of *spray* from the horizontal scan circuits feeding into the *rf/if/* video stages in such a manner as to depress the finish edge of sync into the white region. Naturally, the same rope-like vertical line makes its appearance.

To compound the problem somewhat more, there are a few other conditions that occur, causing similar visible defects:

(*1*) Technical difficulties at the TV station.

(2) Difficulties in the receiving antenna.

(3) Reflection conditions in the signal received.

In studying these problems, it was found that these difficulties could be eliminated by blanking the picture tube into cutoff during retrace, by using a sample of the yoke power required to scan for the control voltage on either the grid or the cathode of the picture tube.

The method devised to provide this blanking features two small coils which pick up a sample of the scanning power and apply it in series with the picture-tube cathode lead to cut off the picture-tube during retrace. The two coils are situated at opposite sides of the yoke and connected in an adding configuration. One coil picks up, for example, a positive flyback pulse and ringing of one polarity. The other coil picks up a positive flyback pulse also, but has the ringing in exactly equal amplitude but opposite polarity as the first coil. Since the coils are connected in series, the output is made at one of the two coils, i.e., flyback pulse adding and ringing cancelling. A resistor is connected in the picture-tube lead to insure failure-proof operation in case of a disconnection.

Blanking Coils

Blanking provided with the pickup coils is shown in Fig. 5 above.

In installing the horizontal retrace blanking device, one must first, determine the manner in which the video is applied to the picture tube on the receiver. This can be done by consulting the service notes of the particular receiver involved. A secondary way, if the notes are not available, would be to touch the grid and cathode pins of the picture tube with the blade of a long screwdriver

(*Continued on page 28*)

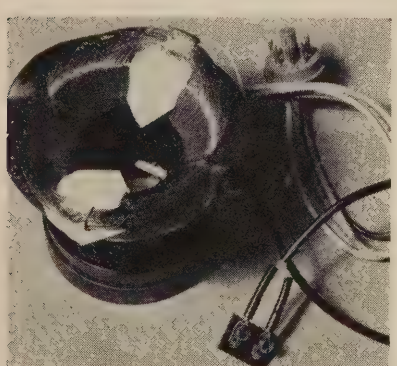


FIG. 7: HOW YOKE is installed. The horizontal yoke windings are situated vertically, one above the other; these windings are usually those nearest the neck and bell of the picture tube when installed in operating position.

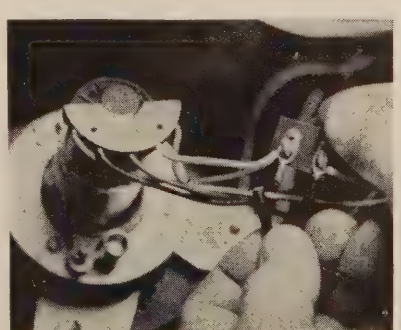


FIG. 8: THE DISCONNECT PLUG as installed in the picture-tube socket leads.

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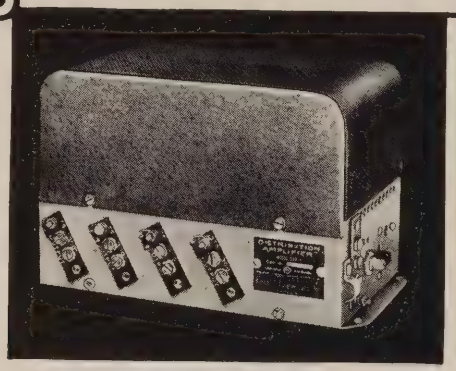

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INDUSTRY NEWS

CHICAGO HI-FI SHOW

THE INSTITUTE OF HIGH FIDELITY Manufacturers 1957 Chicago Music and High Fidelity Show will be held September 17-21 at the Morrison Hotel, Chicago.

Members of the Institute's advisory show committee are *William Grommes,* Precision Electronics; *Irv Rose,* Allied Radio Corp.; *Howard Souther,* Electro-Voice, Inc:; *Bill Ellinger Jr.,* W. H. Ellinger Sales Corp.; *Jim Goodwillie,* Milwaukee Hi-Fi Center; *Ralph Glover,* Jensen Mfg. Co.; *Bob Karet,* Karet-Margolin, Inc.; *Sam Poncher,* Newark Electric Co.; *Irving Rossman,* The Pentron Corp.; *Ed Miller,* Sherwood Electronic Labs, Inc., and *Ted Selleisen,* Selleisen Associates.

* * *

NEW RESISTOR LINE

THE ELECTRONIC DISTRIBUTOR sales division of Erie Resistor Corp. has announced that its authorized distributors of Corning Glass electronic components are now carrying Corning Glass styles *R* and *S* high and low power resistors.

* * *

TUBE TESTER CHARTS

THREE NEW ELECTRONIC TUBE tester roll charts have been announced by Sylvania Electric Products, Inc., 1891 E. Third St., Williamsport, Pa.

Designed for use with Sylvania testers, charts feature approximately 100 new tube types: Chart PC15845-N is for use with testers 139 and 140; chart PC18325-K with testers 219 and 220; chart PC25700-C for use with tester 620.

* * *

13TH ANNUAL NATIONAL ELECTRONICS CONFERENCE

THE 13TH ANNUAL National Electronics Conference will be held October 7-9 at the Hotel Sherman in Chicago.

Approximately 100 technical papers will be read and 240 will exhibit.

All-American Award

ALL-AMERICAN AWARD trophy to be awarded by G. E. to eleven television Service Men who have performed outstanding community service. In addition to the trophies, winners will receive a $500 check for use in a public service activity or charity of their preference.

CATALOGS—BOOKS

IE MANUFACTURING, 325 North Hoyne Ave., Chicago 12, Ill., has issued a 32-page catalog covering its line of TV hardware accessories, guy wire, telescoping masts and masting.

* * *

HOWARD W. SAMS & CO., Inc., 2201 E. 46th Street, Indianapolis, Ind., has announced release of volume 9 of the *Automatic Record Changer and Tape Recorder Service Manual.* Book presents information on fourteen tape recorders and four record changers produced in '56. Index lists all models which were presented in the first eight volumes as well as those covered in volume 9. A cross-reference index identifies makes and models of changers used in various radio and television receivers. Contains 256 pages; sells for $3.95.

* * *

PERMA-POWER CO., 3100 N. Elston Ave., Chicago 18, Ill., has published literature on four new Perma-Power products; picture tube restorers, color gun killer, color-tube adapter and the A-400 transistor power supply.

* * *

REEVES SOUNDCRAFT CORP., 10 East 52nd St., N. Y. C., has prepared a pamphlet titled *How to Choose the Right Recording Tape.* Brochure offers information on magnetic recording tape, recording characteristics and the elements, such as Mylar and cellulose acetate, which govern the physical characteristics of the product.

* * *

GENERAL ELECTRIC, Semiconductor Products Department, Syracuse, N. Y., has announced publication of the second edition (112 pages) of the *Transistor Manual.* Included is information on basic semi-conductor theory, construction techniques used to make the various types of transistors now on the market, explanations of transistor specification symbols now in common use and specifications with outline drawings of all transistors registered with the Electronic Industries Association (formerly RETMA). The booklet now includes circuit diagrams for twenty-nine different pieces of equipment ranging from a simple transistorized code-practice oscillator to a sun-cell triggered relay and a completely transistorized high-fidelity amplifier system. This edition of the manual is priced the same as the first edition, fifty cents.

* * *

THE RCA ELECTRON TUBE DIVISION has announced publication of *John B. Meagher's* Pict-O-Guide for Color Television, a 200-page volume of step-by-step instructions in the installation, adjustment and servicing of color TV receivers. More than 100 illustrations in full color and scores of pictures and graphs in black-and-white are throughout the volume. A multi-ring binder holds the pages flat for reference during service work.

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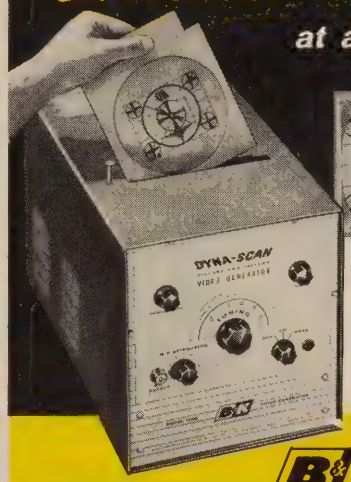

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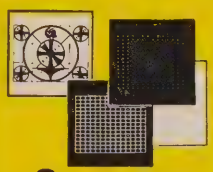

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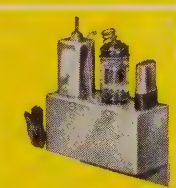

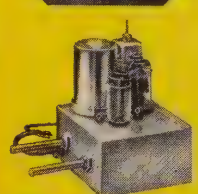

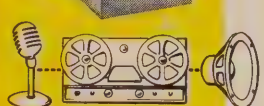

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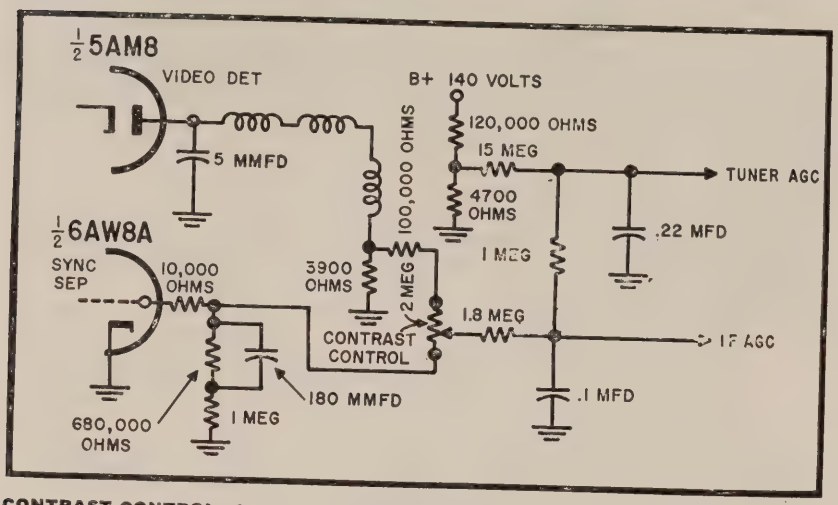
Wide-Angle 17-Inch TV Portable Circuitry

Analysis of 110° Chassis Which Feature Unique Contrast-Control System In AGC Line

by ERNEST C. FREELAND
TV Engineering Department, Philco Corp.



CONTRAST-CONTROL circuit for Philco 8H25 chassis which uses a 17-inch 110° wide-angle picture tube.

THE NEW '58 PHILCO PORTABLE[1] employing the 8H25 chassis has been designed to take full advantage of the 110° picture tube not only from the viewpoint of styling, but simplification of assembly and test in the plant, as well as service in the field.

With these three points in mind the cabinet has been constructed in three sections. The front mask and back cover are of plastic which can be removed with a Phillips type of screw driver. This leaves a metal wrap around the center shell of the cabinet which is attached by drive screws to the brackets of the chassis and picture tube assembly. Adequate clearance has been provided between the chassis and metal section of the cabinet to facilitate factory assembly and removal by Service Men. This can be done by removing the attaching drive screws, disconnecting the speaker, and slipping the cabinet off the rear of the chassis and picture-tube assembly.

The basic circuit is essentially that of a 21" chassis (8L40) except for a unique contrast control circuit developed especially for use in the portable line. This circuit arrangement controls the contrast by varying the *agc* voltage with a potentiometer between the *dc* output of the second detector and that of the sync-separator grid. As the arm of the control is moved from the second detector bias towards the sync separator bias the *agc* bias is increased and the contrast reduced. This permits removal of the contrast control from the video-amplifier circuits where capacity loading of the plate circuit is a problem, especially when the control must be located at some distance from the video stage, as is often the case in portable design.

The contrast control adjusts the *agc* loop gain and hence makes it possible to drive the video amplifier to its full capability for increased video drive to the picture tube and improved picture contrast. At the same time, removal of the contrast control from the video plate circuit has made possible improved transient response and overall picture quality. Adequate range of contrast is provided so that very low contrast is available for operation with dim room lighting.

The *if* amplifier employs three stages of amplification and has two 47.4-mc adjacent sound traps; the frequency of the trap has been moved by 150 kc. On those locations where adjacent channel interference from the sound carrier is a problem, this change in trap frequency will permit tuning the picture carrier down the side of the *if* response curve for a sharper picture and at the same time place the adjacent sound at the center of the trap. The end result has been found to be improved picture quality for medium fringe areas where adjacent channel sound interference may be encountered.

This portable employs a chassis with many electromechanical features included to facilitate production and service. The chassis has been laid out so that most of the service and all of the testing can be carried out with the picture tube in place as an integral part of the chassis.

Removal of the plastic back exposes the tubes and most of the voltage and waveform test points, as well as most of the small components of the chassis. Except for the picture tube, all of the tubes including the *hv* rectifier behind the *hv* cage cover can be removed for testing with the chassis in the cabinet.

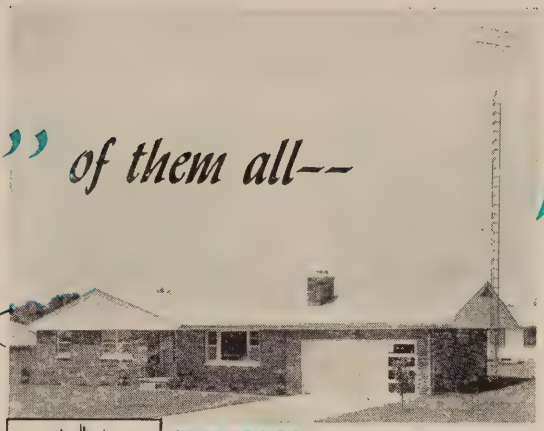
The height and linearity adjustments are concentric with the vertical hold and brightness controls and are accessible with a small screwdriver through holes provided in the knobs of these controls. With the back removed, the remaining adjustments pertaining to raster geometry are readily accessible. The plastic yoke cover, which also supports the centering rings, provides shock protection so that the picture can be centered and the raster leveled while the receiver is in operation. The plastic cup is keyed to the yoke housing in the front and clamped to the picture-tube neck in the rear, so as to retain the adjustments. The clamp consists of a spring wire ring whose tension can be momentarily released for leveling adjustments.

With the chassis removed from the cabinet, such major components as the tuner and flyback transformer can be removed without disturbing the picture-tube assembly. The tuner is secured to the chassis by three drive screws accessible at the rear plane of the chassis. There are three voltage

(*Continued on page 29*)

[1] *Using the 8H25 chassis; trademarked the Slender Seventeener.*

The "GEM" of them all-- ROHN



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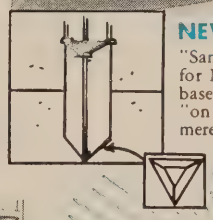

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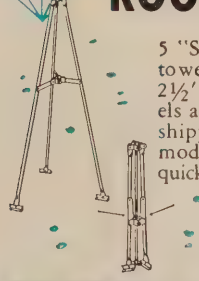

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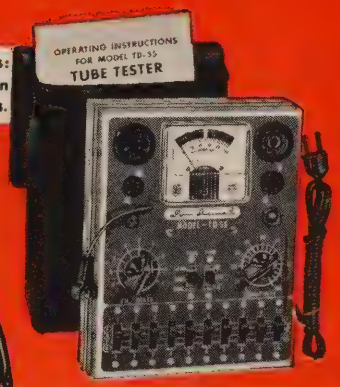
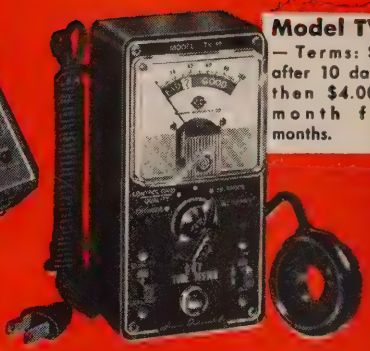


Model TV-12 — Terms: $22.50 after 10 day trial then $10.00 per month for 5 months.



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Superior's New Model TV-40

PICTURE TUBE TESTER

Not a Gadget—Not a Make-Shift Adapter, but a Wired Picture Tube Tester With a Meter for Measuring Degree of Emission—at Only $15.85

Of course you can buy an adapter for about $5—which theoretically will convert your standard tube tester into a picture-tube tester; or a neon type instrument which sells for a little more and is supposed to be "as good as" a metered instrument. Superior does not make nor do they recommend use of C.R.T. adapters or neon gadgets because a Cathode Ray Tube is a very complex device, and to properly test it, you need an instrument designed exclusively to test C. R. Tubes and nothing else.

Tests ALL magnetically deflected tubes . . . in the set . . . out of the set . . . in the carton! !

- Tests all magnetically deflected picture tubes from 7 inch to 30 inch types.
- Tests for quality by the well established emission method. All readings on "Good-Bad" scale.
- Tests for inter-element shorts and leakages up to 5 megohms.
- Test for open elements.

EASY TO USE: Simply insert line cord into any 110 volt A.C. outlet, then attach tester socket to tube base (ion trap need not be on tube). Throw switch up for quality test . . . read direct on Good-Bad scale. Throw switch down for all leakage tests.

Only..... **$15.85 NET**

Superior's New Model TV-12

TRANS-CONDUCTANCE TUBE TESTER

TESTING TUBES

- **Employs improved TRANS-CONDUCTANCE circuit.** An in-phase signal is impressed on the input section of a tube and the resultant plate current change is measured. This provides the most suitable method of simulating the manner in which tubes actually operate in Radio & TV receivers, amplifiers and other circuits. Amplification factor, plate resistance and cathode emission are all correlated in one meter reading.
- **NEW LINE VOLTAGE ADJUSTING SYSTEM.** A tapped transformer makes it possible to compensate for line voltage variations to a tolerance of better than 2%.
- **SAFETY BUTTON**—protects both the tube under test and the instrument meter against damage due to overload or other form of improper switching.
- **NEWLY DESIGNED FIVE POSITION LEVER SWITCH ASSEMBLY.** Permits application of separate voltages as required for both plate and grid of tube under test, resulting in improved Trans-Conductance circuit.

Extra Feature

Model TV-12 Also Tests Transistors!

A transistor can be safely and adequately tested only under dynamic conditions. The Model TV-12 will test all transistors in that approved manner, and quality is read directly on a special "transistor only" meter scale.

The Model TV-12 will accommodate all transistors including NPN's, PNP's Photo and Tetrodes, whether made of Germanium or Silicon, either point contact or junction contact types.

Housed in hand-rubbed oak cabinet..... **$72.50 NET**

Superior's New Model TW-11

STANDARD PROFESSIONAL TUBE TESTER

- Tests all tubes, including 4, 5, 6, 7, Octal, Lockin, Hearing Aid, Thyratron, Miniatures, Sub-miniatures, Novals, Sub-minars, Proximity fuse types, etc.
- Uses the new self-cleaning Lever Action Switches for individual element testing. Because **all elements are numbered according to pin-number in the RMA base numbering system,** the user can instantly identify which element is under test. Tubes having tapped filaments and tubes with filaments terminating in more than one pin are truly tested with the Model TW-11 as any of the pins may be placed in the neutral position when necessary.
- The Model TW-11 does not use any combination type sockets. Instead individual sockets are used for each type of tube. Thus **it is impossible to damage a tube by inserting it in the wrong socket.**
- Free-moving built-in roll chart provides complete data for all tubes. All tube listings printed in large easy-to-read type.

NOISE TEST: Phono-jack on front panel for plugging in either phones or external amplifier will detect microphonic tubes or noise due to faulty elements and loose internal connections.

EXTRAORDINARY FEATURE: SEPARATE SCALE FOR LOW-CURRENT TUBES. Previously, on emission-type tube testers, it has been standard practice to use one scale for all tubes. As a result, the calibration for low-current types has been restricted to a small portion of the scale. The extra scale used here greatly simplifies testing of low-current types. ***Housed in hand-rubbed oak cabinet***..... **$47.50 NET**

USE APPROVAL FORM ON NEXT PAGE

Model TV-50 — Terms: $11.50 after 10 day trial then $6.00 per month for 6 months.

Model 76—Terms: $6.95 after 10 day trial then $5.00 per month for 4 months.

Model 770-A — Terms: $3.85 after 10 day trial then $4.00 per month for 3 months.

Model 670-A — Terms: $7.40 after 10 day trial then $3.50 per month for 6 months.

TRY FOR 10 DAYS

before **you buy!** ***then*** **if satisfactory pay in easy, interest free, monthly payments. See coupon below.**

Superior's New Model TV-50 GENOMETER

7 Signal Generators in One!

- ✔ R.F. Signal Generator for A.M.
- ✔ R.F. Signal Generator for F.M.
- ✔ Audio Frequency Generator
- ✔ Bar Generator
- ✔ Cross Hatch Generator
- ✔ Color Dot Pattern Generator
- ✔ Marker Generator

R. F. SIGNAL GENERATOR: 100 Kilocycles to 60 Megacycles on fundamentals and from 60 Megacycles to 180 Megacycles on powerful harmonics.

VARIABLE AUDIO FREQUENCY GENERATOR: Provides a variable 300 cycle to 20,000 cycle peaked wave audio signal.

BAR GENERATOR: Pattern consists of 4 to 16 horizontal bars or 7 to 20 vertical bars.

CROSS HATCH GENERATOR: Pattern consists of non-shifting horizontal and vertical lines interlaced to provide a stable cross-hatch effect.

DOT PATTERN GENERATOR (FOR COLOR TV): The Dot Pattern projected on any color TV Receiver tube by the Model TV-50 will enable you to adjust for proper color convergence.

MARKER GENERATOR: The following markers are provided: 189 Kc., 262.5 Kc., 456 Kc., 600 Kc., 1000 Kc., 1400 Kc., 1600 Kc., 2000 Kc., 2500 Kc., 3579 Kc., 4.5 Mc., 5 Mc., 10.7 Mc., (3579 Kc. is the color burst frequency.)

Complete with shielded leads..... **$47.50 NET**

Superior's New Model 670-A SUPER-METER

A Combination VOLT-OHM MILLIAMMETER *PLUS* Capacity, Reactance, Inductance and Decibel Measurements.

ADDED FEATURE: Built in ISOLATION TRANSFORMER reduces possibility of burning out meter through misuse.

SPECIFICATIONS:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5/15 Amperes
RESISTANCE: 0 to 1,000/100,000 Ohms 0 to 10 Megohms
CAPACITY: .001 to 1 Mfd. 1 to 50 Mfd. (Good-Bad scale for checking quality of electrolytic condensers.)
REACTANCE: 50 to 2,500 Ohms 2,500 Ohms to 2.5 Megohms
INDUCTANCE: .15 to 7 Henries 7 to 7,000 Henries
DECIBELS: —6 to +18 +14 to +38 +34 to +58

Complete with test leads..... **$28.40 NET**

Superior's New Model 76

- ✔ IT'S A CONDENSER BRIDGE
- ✔ IT'S A RESISTANCE BRIDGE
- ✔ IT'S A SIGNAL TRACER
- ✔ IT'S A TV ANTENNA TESTER

SPECIFICATIONS

✔**CAPACITY BRIDGE SECTION** 4 Ranges: .00001 Microfarad to .005 Microfarad; .001 Microfarad to .5 Microfarad; .1 Microfarad to 50 Microfarads; 20 Microfarads to 1000 Microfarads. Will also measure the power factor of all condensers from .1 to 1000 Microfarads.

✔**RESISTANCE BRIDGE SECTION** 2 Ranges: 100 ohms to 50,000 ohms; 10,000 ohms to 5 megohms.

✔**SIGNAL TRACER SECTION** With the use of the R.F. and A.F. Probes included with the Model 76, you can make stage gain measurements, locate signal loss in R.F. and Audio stages, localize faulty stages, locate distortion and hum, etc.

✔**TV ANTENNA TESTER SECTION** Loss of sync., snow and instability are only a few of the faults which may be due to a break in the antenna, so why not check the TV antenna first? Locates a break in any TV antenna and measures the location of the break in feet from the set terminals.

Complete with R.F. and A.F. probes and test leads..... **$26.95 NET**

Superior's New Model 770-A POCKET-SIZED VOLT-OHM MILLIAMMETER

● USING THE NEW "FULL-VIEW" METER 71% MORE SCALE AREA—Occupies exactly the same space used by the older standard 2½" Meters, yet provides 71% more scale area. As a result, all calibrations are printed in large easy-to-read type and for the first time it is now possible to obtain *measurements instead of approximations.*

● Compact—measures 3⅛" x 5⅞" x 2¼". ● Uses "Full View" 2% accurate, 850 Microampere D'Arsonval type meter. ● Housed in round-cornered, molded case. ● Beautiful black etched panel.

Specifications: **6 A.C. VOLTAGE RANGES:** 0-15/30/150/300/1500/3000 Volts. **6 D.C. VOLTAGE RANGES:** 0-7.5/15/75/150/750/1500 Volts. **2 RESISTANCE RANGES:** 0-10,000 Ohms, 0-1 Megohm. **3 D.C. CURRENT RANGES:** 0.15/150 Ma., 0-1.5 Amps. **3 DECIBEL RANGES:** —6 db to + 18 db, + 14 db to + 38 db, + 34 db to + 58 db.

Complete with test leads..... **$15.85 NET**

We invite you to try before you buy any of the models described on this and the preceding page. If after a 10 day trial you are completely satisfied and decide to keep the Tester, you need send us only the down payment and agree to pay the balance due at the monthly indicated rate.

NO INTEREST OR FINANCE CHARGES ADDED!

If not completely satisfied, you are privileged to return the Tester to us, cancelling any further obligation.

MOSS ELECTRONIC DISTRIBUTING CO., INC.
Dept. D-397, 3849 Tenth Ave., New York 34, N. Y.

Please send me the units checked. I agree to pay down payment within 10 days and to pay the monthly balance as shown. It is understood there will be no finance or interest charges added. It is further understood that should I fail to make payment when due, the full unpaid balance shall become immediately due and payable.

Name .....

Address .....

City ..... Zone..... State.....

All Prices net. F.O.B. N.Y.C.

- ☐ Model TW-11.....Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.
- ☐ Model 76.....Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.
- ☐ Model TD-55.....Total Price $26.95 $6.95 within 10 days. Balance $5.00 monthly for 4 months.
- ☐ Model TV-50.....Total Price $47.50 $11.50 within 10 days. Balance $6.00 monthly for 6 months.
- ☐ Model TV-40.....Total Price $15.85 $3.85 within 10 days. Balance $4.00 monthly for 3 months.
- ☐ Model 670-A.....Total Price $28.40 $7.40 within 10 days. Balance $3.50 monthly for 6 months.
- ☐ Model 770-A.....Total Price $15.85 $3.85 within 10 days. Balance $4.00 monthly for 3 months.
- ☐ Model TV-12.....Total Price $72.50 $22.50 within 10 days. Balance $10.00 monthly for 5 months.

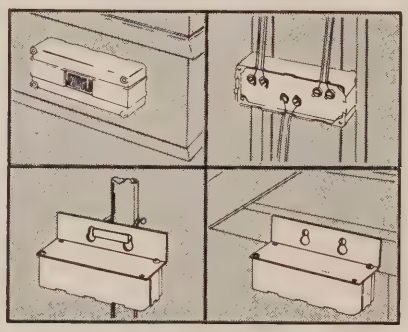
The Case of The Serviceman WHO SAVED A MARRIAGE!

Smith wanted to watch the fights; Mrs. Smith insisted on "This Is Your Wife". Fights they got, since a second set was within their means but there was only one antenna and no multi-set coupler they tried had worked satisfactorily.

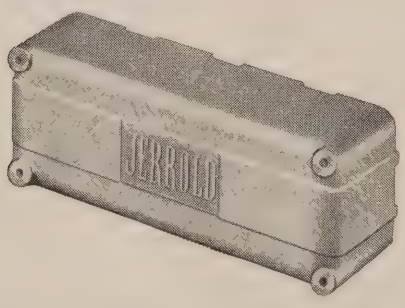
"You won't need another antenna with this 'NEW' Jerrold Multi-set COUPLER", said the TV Serviceman. "Its special design allows for equal distribution of the signal with *exceptionally low loss* and without smearing or ghosting"

The Jerrold multi-set coupler took only minutes to install . . . now, both the Smiths watch their favorite TV shows.

UNIVERSAL MOUNTING



- **On the baseboard. Connectors completely concealed.**
- **In the attic or basement with terminals exposed for ease of servicing.**
- **Outdoors, on the antenna mast or on the side of the house.**



***New!* JERROLD LOW LOSS COUPLERS**

Available in 3 models

M-2—for strong signal areas . . list $3.50
MF-2—for fringe areas . . . . . list 4.50
MF-4—up to 4 sets—all areas . list 5.75

Engineered for V.H.F., U.H.F., Color reception. See your Jerrold Distributor or write for complete information to Dept. P.D. #10

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LOOK TO JERROLD FOR AIDS TO BETTER TELEVIEWING

TV Horizontal Retrace

(*Continued from page* 21)

(usually the green and yellow leads, respectively). The screwdriver should be held by the insulated handle. The picture quality should be observed during this test, and the test that gives a degraded picture, or a flickering picture, determines the presence of *video* at that point.

Then, the *non-video* grid or cathode lead should be cut about 3″ away from the socket, making sure that the correct lead is cut. Each lead end should be stripped about ¼″.

The terminal block can be installed in this lead as shown in Fig. 8; p. 21.

Now the yoke should be removed from the receiver and the small coils installed as shown in Fig. 7; p. 21. Like colors of the coils should be installed facing front or back. The exact position is not important, but both must be facing in the same polarity as indicated by the color. On some yokes it may not be possible to slip the pickup coils under the yoke as pictured. In this case, the coils can be taped in the same relative position, but on the outside of the yoke windings. The tape must go completely through the yoke and around, so that it can be stuck to itself. (The tape is not capable of sticking too firmly to the yoke itself.)

The yoke and any associated parts that may have been removed can then be reinstalled.

The picture can now be adjusted for centering, focus, brightness, etc., as normally done.

Finally the pickup coil leads can be connected to the terminal block and the picture observed. The connections to the terminal block should be reversed and the picture again observed.

Two-Way Bus Installation

A TWO-WAY radio system, to provide direct communication between the dispatcher and bus drivers, installed on the Monroe-North Clinton line buses in Rochester, N. Y. The communication system incorporates transistor equipment. The two-way system enables bus drivers to report immediately any traffic delays, mechanical difficulties, unexpected concentrations of passengers, accidents, or other situations.

Wide-Angle TV Portable

(*Continued from page 24*)

supply leads between the tuner and chassis plus the *if* link connection; this link connection is accessible by removing a drive screw and lifting an end *tab* of the *if* shield. The high-voltage cage is secured to the chassis by drive screws which may be removed with a flexible shaft socket wrench. This exposes the panel terminals and mounting screws of the flyback transformer. The *hv* rectifier filament terminals are located on the picture tube side of the *hv* socket which projects through the sub-base.

A large printed panel carries the sync, sound, video and deflection-oscillator circuits. Through-solder grounding and mounting tabs used on this panel, as well as the *if* panel, were developed by engineering to provide not only positive electrical grounds, but for easy removal of the panel with soldering iron or gun.

Lugged RC Network Units

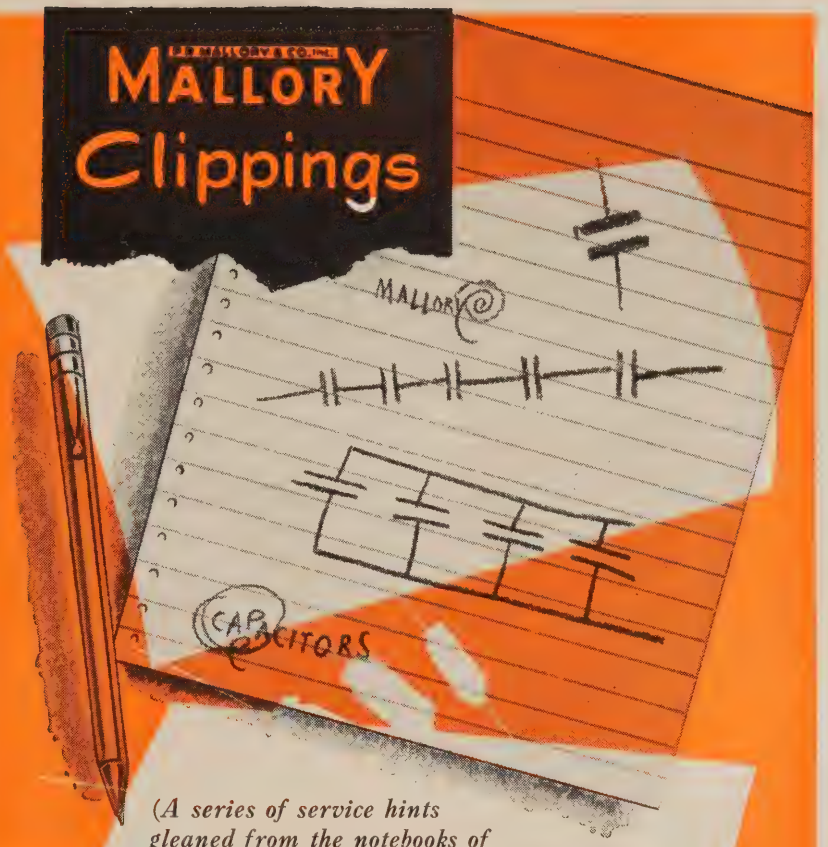
As previously noted, nearly all of the testing and servicing of this section can be carried out with the panel in place and in many cases with the chassis in the cabinet. Even the *rc* networks have lugs, so that the components and base panel of the network can be cut away with a pair of diagonal cutters exposing the panel connecting lugs, which can be used as solder tabs for insertion of the replacement network without removal of the large panel.

The *if* cores and wire wrap lugs have been located so as to provide for test jig connections and complete *if* alignment without removal of the chassis from the cabinet. Voltage test points are also accessible through location of the wire wrap lugs, as well as the leads of many of the components on the large panel.

Fusable Resistor Used

A *fusable resistor* (plug-in type) has been included to simplify replacement and protect the components of the power supply in the event of a short circuit. The resistor also corrects the wave shape of the current for a high-efficiency germanium power rectifier which was designed into the chassis. This semiconductor rectifier which has a low power loss, has been found to be very reliable, and has less power loss, thus reducing cabinet temperature, hence improving the life of other components of the circuit.

MALLORY Clippings



(A series of service hints gleaned from the notebooks of Mallory design and application engineers)

Sometimes you can't find exact-replacement capacitors, especially for some of the older or less popular equipment. Here are a few rules regarding simple substitutions. Obviously, some of these call for physically larger or slightly more expensive capacitors—but that's better than throwing away perfectly good equipment.

In virtually all radio and TV applications, higher voltage ratings or higher capacities can be used at any time.

Individual sections of multiple units can be connected together in parallel to obtain needed capacity, even though they are of different voltage ratings. The lowest voltage rating of all capacitors connected in parallel applies.

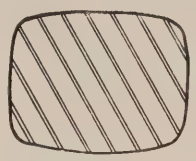
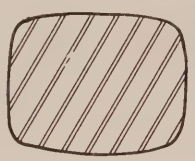
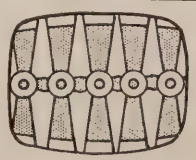
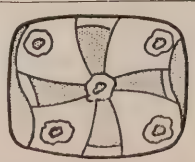
Two like capacitors may be connected in series to provide a capacitor with a voltage rating twice as high. The capacity of each section must be twice the actual capacity required. Insulate lead between units and case of capacitor above ground potential. Equalizing resistors are not required.

Regardless of the circuit—you can count on Mallory capacitors to do any service job—right. See your Mallory Distributor, today, and lay in a working replacement stock.

P.R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO. Inc., INDIANAPOLIS 6, INDIANA

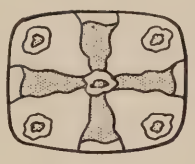
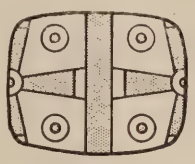
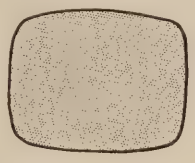
Capacitors • Controls • Vibrators • Resistors • Switches • Rectifiers
Power Supplies • Filters • Mercury and Zinc-Carbon Batteries

Troubleshooting Horizontal

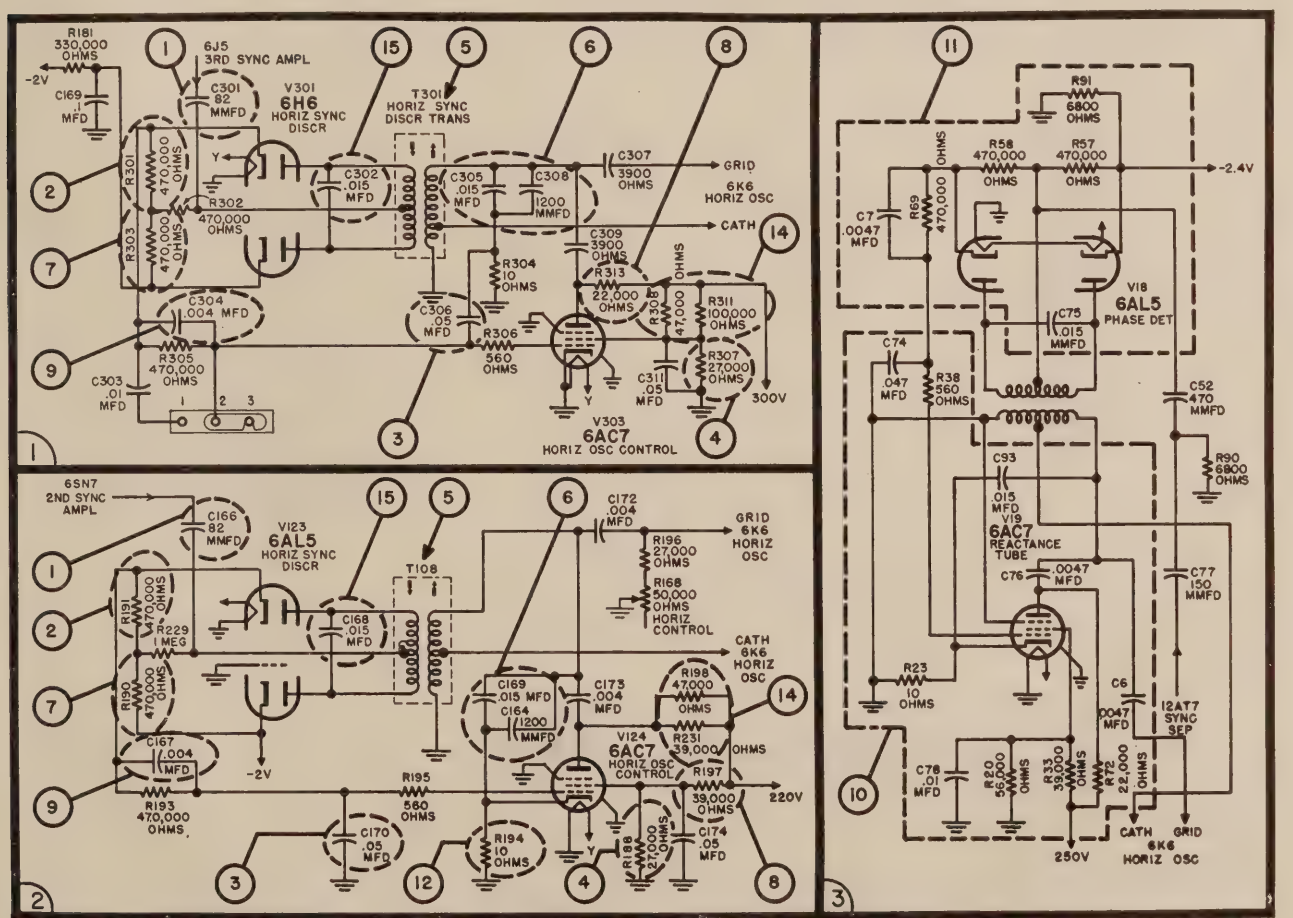
Trouble	Picture Indication	Cause	Remedy
Loss of horizontal sync; diagonal bars slant toward right. **(A)**		Oscillator frequency set too high. Following components may be defective: R_{301} (470,000 ohms) or R_{307} (27,000 ohms) may be open; C_{301} (82 mmfd), C_{306} (.05 mfd), C_{305} (.015 mfd) or C_{308} (1200 mmfd) may be defective, shorted or leaky; or T_{301} has shorted turns. ***See circles 1, 2, 3, 4, 5 and 6 in Fig. 1.*** Also check C_{166} (82 mmfd), R_{101} (470,000 ohms), C_{170} (.05 mfd), R_{188} (27,000 ohms), C_{164} (1200 mmfd), C_{169} (.015 mfd) and T_{108}. ***See circles 1, 2, 3, 4, 5 and 6 in Fig. 2.***	Replace defective component.
Note: Horizontal-hold control can bring in picture momentarily, but with vertical blanking bar visible. This also applies to the loss of horizontal sync condition when diagonal bars move towards left.			
Loss of horizontal sync; diagonal bars slant toward left. **(B)**		Oscillator frequency too low. Following components may be defective: R_{303} (470,000 ohms) or R_{313} (22,000 ohms) may be open; C_{301} (82 mmfd) or C_{304} (.004 mfd) may be open; or C_{302} (.015 mfd) may be shorted. ***See circles 1, 2, 8 and 9 in Fig. 1.***	Replace defective component.
Loss of horizontal sync; sync brought in momentarily with 6AC7 removed and T_{10} (in Fig. 3) readjusted. **(See A-B)**		Trouble lies in 6AC7 circuit. Following components should be checked: R_{20} (56,000 ohms), R_{23} (10 ohms), R_{33} (39,000 ohms), R_{28} (560 ohms), R_{72} (22,000 ohms), C_{74} (.047 mfd), C_{76} (.0047 mfd), C_{78} (.01 mfd), and C_{83} (.015 mfd). ***See circle 10 in Fig. 3.***	Replace defective component.
Loss of horizontal sync; sync brought in momentarily with 6AL5 removed and T_{10} (Fig. 3) readjusted. **(See A-B)**		Trouble lies in 6AL5 circuit and following components should be checked: R_{87} (470,000 ohms), R_{88} (470,000 ohms), R_{89} (470,000 ohms), R_{90} (6800 ohms), C_6 (.0047 mmfd) and C_{75} (.015 mfd). ***See circle 11 in Fig. 3.***	Replace defective component.
Loss of horizontal sync; during set warmup time horizontal-hold control has to be adjusted several times. **(See A-B)**		Four capacitors—C_{164} (1200 mmfd), C_{169} (.015 mfd), C_{305} (.015 mfd), C_{308} (1200 mfd) change value slightly or are improper replacements; these are temperature-compensating capacitors. ***See circle 6 in Figs. 1 and 2.***	Replace capacitors only with types recommended by set manufacturer.
Extreme loss of horizontal sync (hash) and squealing. **(C)**		R_{191} (10 ohms) is open. ***See circle 12 in Fig. 2.***	Replace resistor.
Horizontal overlapping pictures, or loss of horizontal sync. **(D)**		Coil *A-B* of R_{108} or T_{201} has been misadjusted or is faulty. ***See circle 5 in Figs. 1 and 2.***	Align T_{108} properly or replace.
Horizontal pulling; S-picture. **(E)**		C_{304} (.004 mfd) or C_{167} (also .004 mfd) is shorted. ***See circle 9 in Figs. 1 and 2.***	Replace defective capacitor.

AFC Synchrolock Circuits

by JESSE DINES

Trouble	Picture Indication	Cause	Remedy
Wavy or bending picture.	 (F)	C_{306} (.05 mfd) is leaky or open, T_{301} has been misaligned, or R_{308} (47,000 ohms), R_{311} (100,000 ohms), or R_{313} (22,000 ohms) have decreased in value. ***See circles 3, 5, 8 and 14 in Fig. 1.*** Also check C_{170} (.05 mfd), T_{108}, R_{197} (39,000 ohms), R_{198} (47,000 ohms) and R_{231} (39,000 ohms). ***See circles 3, 5, 8 and 14 in Fig. 2.***	Replace defective component; align T_{301} or T_{108}.
Vertical blanking bar; split picture.	 (G)	C_{301} (82 mmfd) is leaky, C_{302} (.015 mfd) is open or F-D of T_{301} has been misaligned. ***See circles 1, 15 and 5 in Fig. 1.*** Also check C_{166} (82 mmfd), C_{186} (.015 mfd) and T_{108}. ***See circles 1, 15 and 5 in Fig. 2.***	Replace defective component; align T_{301} or T_{108}.
No raster.	 (H)	C_{305} (.015 mfd) or C_{306} (.05 mfd) is shorted or T_{108} has an open winding. ***See circles 6, 5 and 12 in Fig. 1.*** Also check C_{164} (1200 mmfd) and C_{169} (.015 mfd). ***See circles 6, 5 and 12 in Fig. 2.***	Replace defective component.

Note: If R_{191} (10 ohms) opens (Fig. 2), the same no-raster condition may obtain.

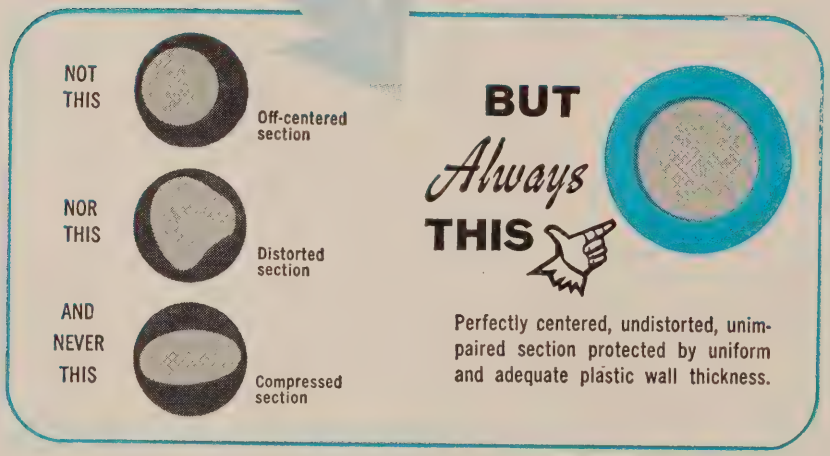


FIGS. 1, 2, 3: SYNCHROLOCK circuit used in RCA model 648PV appears in Fig. 1. The Crosley (model 9-408) synchrolock circuit is in Fig. 2, and Fig. 3 shows the synchrolock system used in the Zenith 27F20 chassis.

Here's why

tubular capacitors give you better performance and longer life!

All Aerovox P88N molded tubular capacitors are manufactured by a unique low-pressure, low-temperature molding process that insures perfectly centered sections with uniform wall thickness on every single unit. Only Aerovox gives you round, uniform, undistorted, coaxially-centered sections solidly imbedded in the *right* plastic for superb mechanical, electrical and climatic characteristics.



That's the inside story why Aerovox Duranite capactiors are recognized for their **top performance** and **utmost reliability** and **extra-generous** service life. Your local Aerovox Distributor carries a complete stock of Aerovox capacitors to meet **ALL** your service needs. Drop in soon and ask for a copy of the latest Aerovox catalog or write

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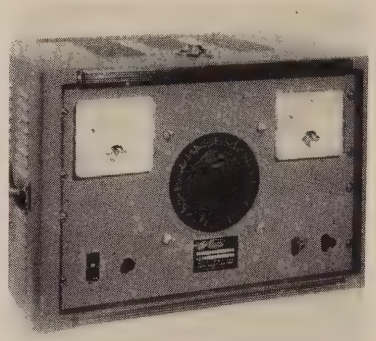
ACCESSORIES

UNIVERSAL DC POWER SUPPLY

A UNIVERSAL 125-v DC power supply, *GFA*, using germanium rectifiers, has been developed by Electro Products Laboratories, 4500 N. Ravenswood Ave., Chicago 40, Ill.

Unit offers a continuously variable 0 to 125 *v* up to 10 amps with, it is claimed, less than 1% ripple at top load. A single control is used for different load conditions over a specific range. Choke input and pi type filters are incorporated.



* * *

PICTURE-TUBE RESTORER

A TV PICTURE-TUBE restorer, *K-201*, designed to repair open or control grid-to-cathode shorts, has been introduced by Perma-Power Co., 3100 N. Elston Ave., Chicago 18, Ill.

Can be used on electrostatic or magnetic-focus picture tubes; in series or parallel-wired filament TV sets.

* * *

TEST PROD ADAPTER

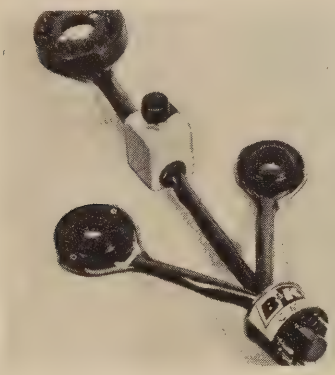
A PROD ADAPTER, *E-Z-Hook*, for converting standard electrical test prods to a self-holding connector, has been announced by E-Z-Hook Test Products, 1536 Woodburn Ave., Covington, Ky.

Adapter slips on-or-off test prod to provide change from a sharp point to a self-holding connector. Unit hooks over a test point with an automatic clamping action for positive test connections. Releases with a light pressure of finger tips. Insulated connector allows connections in crowded spots without danger of shorting to adjacent bare wires or terminals. Has brass chuck which uses four stainless steel, ring-type springs to provide clamping action.

PICTURE-TUBE TESTER/REJUVENATOR ADAPTER

An adapter, C40, for testing and rejuvenating color and 110° picture tubes, when used in conjunction with models 400 and 350 *Dyna-Quick* picture-tube testers, has been introduced by B&K Manufacturing Co., 3731 N. Southport Ave., Chicago 13, Ill.

Unit is said to test each gun of color tube separately for continuity, interelement shorts, opens, leakage, emission and cutoff voltage.



* * *

COLOR-TV SERVICE AIDS

Two service aids for color-TV, a degaussing coil, 9317, and a tool for use on concentric potentiometers and convergence controls, 9299, have been announced by the General Cement Manufacturing Co., 400 S. Wyman St., Rockford, Ill.

Degaussing coil serves to demagnetize fields, concentrates the tube field and dissipates heat generated.

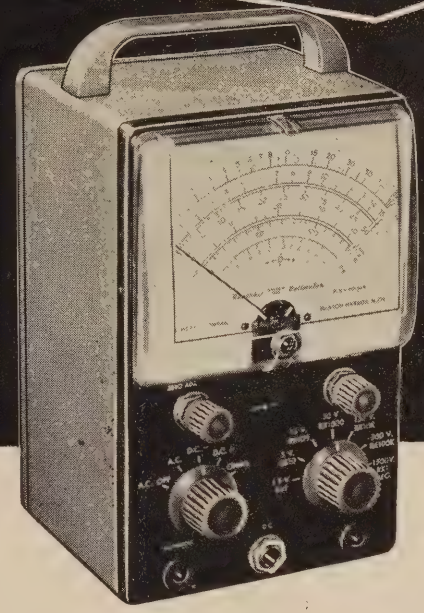
* * *

UNIVERSAL INVERTERS

A line of universal inverters, a combination of four inverter designs in one unit, has been announced by American Television & Radio Co., 300 E. Fourth St., St. Paul 1, Minn.

Units are designed for operating standard *ac* tape recorders, TV sets, *pa* systems, record players, electric drills and electronic test equipment from *dc* voltages in autos, buses, trucks, boats, trains and planes. 110 *v ac* output at 60 cycles is provided with output wattages ranging from 80 to 600 *w*. Features *rf* interference suppression, frequency stability and built-in toggle switch power factor corrector.

look what $24.50 buys in test equipment!



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Converting Six-Volt Two-Way

How To Modify Receiver-Transmitter Filament, Power And

by JACK DARR

FIG. 1: BOTTOM VIEW of RCA CMV-3E1 chassis, after conversion to 12 v. Resistor at lower left side of receiver (bottom) chassis is a relay - dropping resistor.

OPERATORS OF TWO-WAY radio systems are currently faced with a serious conversion problem. Although the situation has been in existence for quite a while, ever since the first cars with 12-volt electrical systems appeared, normal depreciation of equipment has made it more acute at the present time. Cars and trucks, now reaching the end of their economical service life, are being traded in for new vehicles. But the 6-volt equipment, installed in the older cars, still capable of good performance, need not be discarded.

The normal life expectancy of well-built two-way equipment is far beyond the active service life of the vehicle in which it was initially installed. However, the change in supply voltage available has raised a problem involving conversion of the equipment to operate off 12-*v* supplies.

There are two methods which can be used to convert. The first involves the installation of a separate 6-volt electrical system in the car using a 6-volt storage battery mounted at a convenient location, and an extra 6-volt generator (to be driven by the fan belt) installed on the vehicle's engine.

The disadvantage of the battery-generator method is that it may only be used on larger vehicles. Small pickup trucks, passenger cars and other light vehicles, would be seriously crowded by the additional equipment needed. Additional service attention is required, too; maintenance personnel are quite apt to overlook the extra battery when servicing.

The second and probably the best conversion method, involves the changeover of the radio equipment to operate on a 12-*v* system.

The basic circuit of a commercial two-way radio consists of a transmitter and receiver with their individual power supplies, and switching facilities for changing from *receive* to *transmit* condition. Some circuits use interconnection links whereby the receiver's *hv* supply is used to furnish plate and screen voltages for early stages in the transmitter (oscillator, frequency multipliers, etc.), while the transmitter's dynamotor supplies only the *hv* and large currents used in the final *rf* amplifier stages.

In entertainment auto-radios, a simple method of conversion has been used; a large dropping resistor placed in series with the input. With the practically constant drain characteristic of this type of set, these resistor-type conversions have proved very satisfactory. But, due to wide variation in the current consumption of two-way radios, this method has been found to be impractical. In receive condition, the average two-way set may draw from 6-9 amperes; in transmit, it will demand up to 40 amperes. No single resistor could be used under such fluctuations.

To set up a conversion procedure, the set must be broken down into sections, each with smaller and more constant current drains, so that suitable dropping resistors may be used. The standard system may be broken down into a total of five sections; receiver and transmitter filaments, receiver and transmitter power supply, and the various controlling relays. Each of these sections may be treated as a unit.

In Fig. 1 we have a typical two-way,[1] a 60-watt unit which lends itself to conversion.

Although one dropping resistor could be used to handle the receiver filaments as a unit, it has been found best to convert the entire string to 12-*v*, for reasons of current economy. With a total of 13 tubes, filament current would be 2.5 amperes, half of which would be wasted in the dropping resistor. By converting the string to 12-*v*, the resultant current will be 1.2 amperes, which represents quite a saving in wattage.

The Fig. 1 set uses nine 6BH6 tubes, two 12AX7s, one 6AK6 and a 6AL5. Since filament current is identical on the 6BH6's and the 6AK6, these tubes can be arranged in pairs across a 12-*v* line; Fig. 2. The 12AX7s should be reconnected to use 12-*v*, and the remaining tube, the 6AL5, replaced with its 12-*v* equivalent, a 12AL5. In making the change, the wire used should be heavy enough to carry the necessary load without undue drop; braid-covered solid No. 20 hookup wire has been found to be quite adequate.

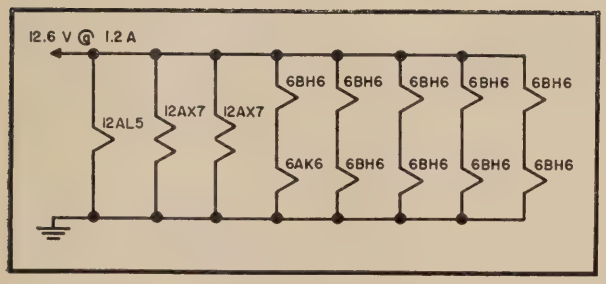
The transmitter filament circuitry presents several problems when a conversion is made. In the Fig. 1 circuit, a 6AK5 serves as an oscillator, a 12AU7 clipper, 5763 double-driver, a pair of 807s in the final amplifier stage, and a pair of 6C4s are also used. Here again identical filament current drains serve to simplify the job.

The 807s should be connected in series, using a small *rf* choke (made

[1] *RCA CMV-3E1.*

Mobile Systems For Twelve-Volt Operation

Relay Circuits To Operate From A 12-Volt Source



(Above)

FIG. 2: FILAMENT STRING of RCA chassis after conversion. Tubes physically adjacent to each other are used in each pair.

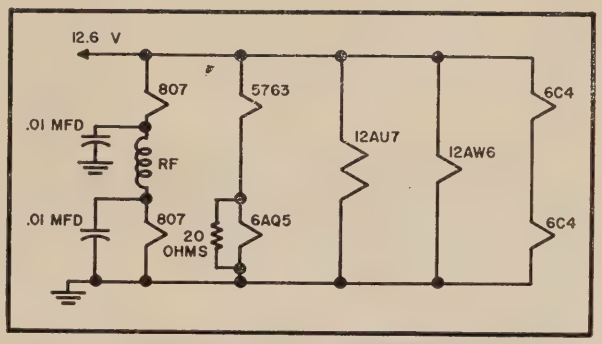


FIG. 3: FILAMENT STRING of transmitter after conversion. Shunting resistor across 6AQ5 filament carries balance of current drawn by 5763. RF choke and bypass capacitors between 807s serve to avoid rf feedback troubles.

by winding about 10 turns of hookup wire around a small screwdriver bit for the interconnecting wire) and bypassing to ground at each filament connection with .01-mfd 1000-*v* ceramic capacitors. This arrangement will be found to prevent interaction between the *rf* potentials on the final filaments.

The two 6C4s should be connected in series and the 12AU7 limiter reconnected for 12 *v*. Now the 6AQ5 tripler, 6AK5 oscillator and 5763 doubler-driver must be connected. You will note that the 6AQ5 has a .45-ampere filament, 6AK5 a .175-ampere filament and 5763 a .175-ampere filament. These odd amperages can be taken care of by substituting a 12AW6 for the 6AK5, a 12-*v* tube with almost identical electrical characteristics, and by connecting the 5763 and 6AQ5 in series. The odd .3 ampere in this series can be shunted by a 20-ohm resistor across the 6AQ5 heater.

There are some models[2] which use a 7-*v* series of loctal tubes; these tubes have 14-*v* electrical equivalents for every type and thus the set need not be rewired at all.

The same situation exists in sets using miniatures, such as 6BH6, to avoid rewiring. There are 12-*v* equivalents for every tube used. In many cases, direct interchange is possible; to illustrate, 12BA6 for 6BA6. In other cases, suitable tube types will be found, such as the 12AW6 for the 6AK5. One must check for maximum plate voltage, interelectrode capacitance, bias and cutoff voltage, sharp or remote cutoff, and transconductance. If any given tube is within 10% of the original, it will probably make a very satisfactory replacement. In many cases, older sets might be improved by using tubes with higher transconductance than the originals. Possibility of oscillation would be the only bar to this procedure, and careful selection of tubes can eliminate this.

Almost all of the sets of the types described use a standardized vibrator-type power supply with a reversible synchronous vibrator, power transformer, etc.

The simplest way to convert these chassis is to install a dropping resistor in series with the input lead.

To determine the correct size for this resistor, a bench test should be made before actual conversion work begins. The receiver should be set up for operation on 6*v*, disconnecting the input lead to the power supply. An 0-10 ampere *dc* ammeter should be connected in series with this lead to measure the actual current drawn by the power supply in full operation. If the bench power supply is of the adjustable type, it might be well to set it up for approximately 7*v*, to stimulate actual operating conditions in a vehicle.

Using this value, one can then compute the size resistor needed for 6 *v* across the power supply. For the first chassis analyzed, where around 2 amperes of current are involved, a 3-ohm resistor with a power rating of 6 watts is required. For best results, it will be found advisable to use a 25-watt adjustable unit, 5 ohms total, mounted on top of the chassis, for better heat dissipation. In practice, the slider of the resistor should be adjusted to provide exactly 6.3 *v* across the power supply, with a 13-*v* input to the set.

Practically all of the older-type sets used dynamotors as a means of obtaining high voltage for the final amplifiers. These have output voltages from 400 to 600 volts *dc* at currents ranging from 100 to 200 ma. Because of the wide range of current-drain

(*Continued on page* 45)

[2] *Motorola FM TRU-80.*

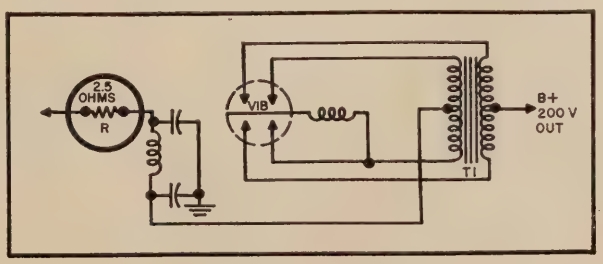
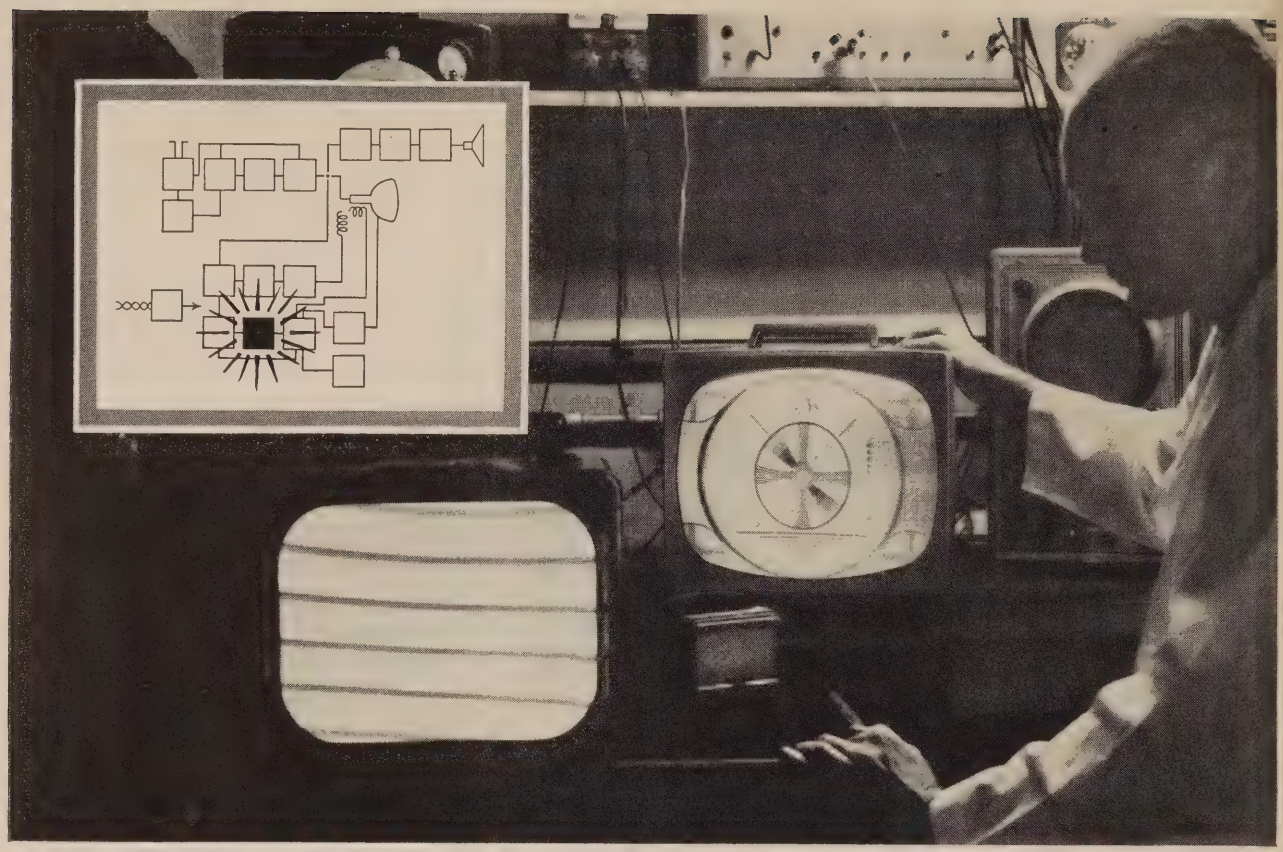


FIG. 4: BASIC schematic of sync vibrator power supply used with almost all receivers; resistor R, installed in series with input, drops voltage across power supply to 6.3.



Here General Electric Application Engineer C. L. Taylor shows what can happen when an old-style horizontal-oscillator tube is used in two different TV sets. Image at left is completely out of sync. To avoid this hazard, the cut-off and other electrical characteristics of General Electric tubes are held within limits that bring satisfactory operation in all television circuits.

Built-in high quality of G-E horizontal-oscillator tubes means fewer TV-servicing call-backs!

Call-back demands from television owners are cut when you install General Electric horizontal-oscillator tubes.

For example: tube microphonics in multivibrator circuits can cause eccentric sync, especially when a set such as a portable is moved or shaken. With G.E.'s 7AU7 and 12AU7, extra-heavy micas, the tight fit of grid side rods, plate, and cathode, and sturdy over-all construction result in minimum microphonics and a steady television picture.

Also, uniform tube-to-tube cut-off characteristics—achieved by care in grid manufacture and rigid testing—enable you to install General Electric types in any receiver knowing that minimum adjustment will be needed for superior picture performance.

Blocking-oscillator circuits require that a tube throughout its life be able to produce peak plate currents 10 to 15 times higher than average. In the 6CG7 and 6SN7-GTB, General Electric scores with a specially processed high-emission, long-life cathode. Peak current capabilities remain high; sync drift is avoided.

For every set, for every socket, G-E receiving tubes mean greater assurance of owner satisfaction . . . and your G-E tube distributor makes prompt delivery. Phone him today! *Distributor Sales, Electronic Components Division, General Electric Co., Owensboro, Ky.*

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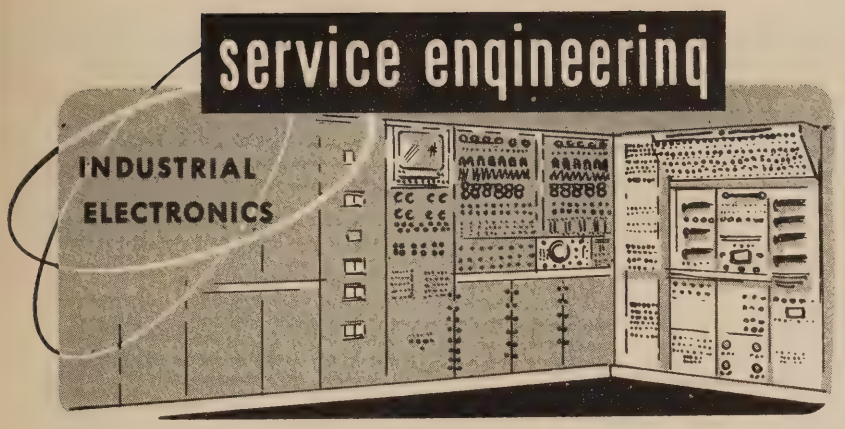
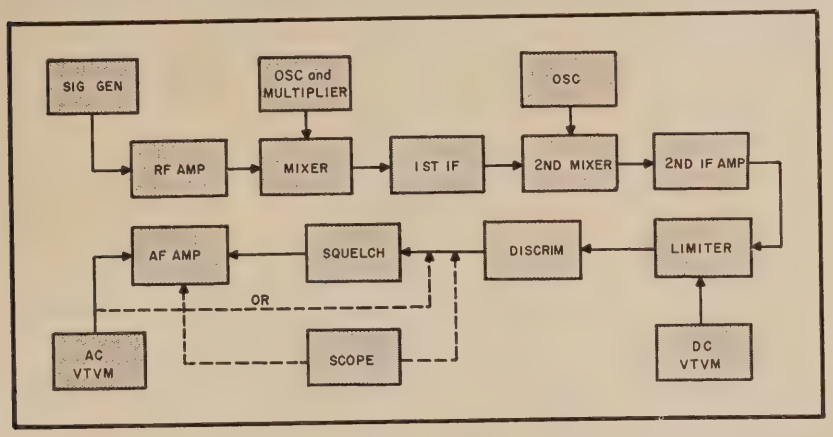


Types And Applications Of Test Instruments Required For Installation-Repair Of Two-Way Receivers And Transmitters



BLOCK DIAGRAM of a 2-way receiver with which a dc vtvm can be used to measure limiter voltage, an ac vtvm can be applied to measure audio, or a 'scope can be tied in to observe an audio signal which may serve to indicate sensitivity and alignment accuracy.

While a television receiver may be more complex than two-way communications equipment, the installation, repair and maintenance of two-way requires a more precision type of test instrument. For not only does the customer depend upon his two-way system to earn or at least save money, but the customer must be protected by the Service Man from violating any FCC regulations. Excessive spurious radiation by transmitters and off-frequency operation cannot be permitted; otherwise the system user, the licensee, is subject to citation by the Federal Communications Commission. In addition, less than optimum performance may reduce the value of two-way to the customer.

While standard *vom's, vtvm's* and other general-purpose instruments are satisfactory for routine troubleshooting, special test equipment designed to high standards is also required. Two-way sets can be serviced and made to work in a fashion, using test equipment which is wholly adequate for servicing home radio and TV sets, but to get optimum performance, the proper advanced type of instruments must be used.

In the two-way station, transmitter power output must be measured with instruments which are much more accurate than the use of light bulbs (brilliance tests) doubling as dummy antennas. *RF* power output meters[1] indicate the actual power directly in watts, while also serving as a 50-ohm dummy load.

Such instruments give a quick and accurate indication of the overall performance of a transmitter. If the transmitter fails to deliver full rated output, the *service engineer* can cast immediate suspicion on tubes of which some types cannot be adequately tested with general-purpose tube testers. An *rf* wattmeter will show up tubes which deliver full power when the transmitter is first turned on, but which droop off after a few seconds or minutes of use. Besides, such an instrument serves as an easy-to-read output indicator when tuning-up transmitters, making it easier to get all the watts built into the set.

Needed, but not yet available at moderate cost, is a device for accurately measuring harmonics and other spurious radiation in the output signal of the transmitter. FCC regulations specify the limits of permitted spurious radiation, but how to measure it presents a problem. A tuneable receiver can be used for detecting spurious radiation, but determination of the strength of each unwanted signal and its identification requires laboratory equipment and methods. Besides, depending upon the receiver used, the receiver itself may reveal signals which are created within the receiver and which may not actually be present in the transmitter's output.

And, of course, every two-way shop must be equipped with an instrument for measuring transmitter frequency to the accuracy specified by the FCC. There are several fixed-tuned, as well as continuous-tuning frequency meters, on the market which meet

(*Continued on page* 46)

[1]*Such as those made by Bird and Sierra.*

Purpose	Instrument	Range
Alignment Signal	*VHF* signal generator	25-175 mc
	UHF signal generator	450-470 mc
	Crystal calibrator or marker generator	Special
Alignment Indicator	*DC vtvm*	100 millivolts—500 *v*
	AC vtvm	20 microvolts—300 *v*
	'Scope	Standard
Tube Checking	General-purpose tube tester	Dynamic mutual-conductance
	Grid-emission tester	50 microamperes or less
Diagnosis	*DC vtvm*	Up to 500 *v*
	AC vtvm	20 microvolts—300 *v*
	Signal tracer	5-175 mc

TWO-WAY receiver test equipment.

THIS MONTH IN SERVICE

COLOR-TV DEVELOPMENTS UNVEILED AT ASSOCIATION SEMINAR--Representatives from fifty associations recently attended a two-day seminar on color-TV, sponsored by a tube and set manufacturer, during which the latest developments in the art were shown. . . . The meeting featured demonstrations of new techniques devised for installation and plant testing which could be duplicated in the home or shop. . . . Also on the agenda was a two-hour all-color closed-circuit program and a tour of a color-tube plant. . . . The session was also highlighted by talks and demonstrations on electronic refrigeration, magnetic memory-transfluxors, electro-mechanical filters, light amplification, and electronic music synthesizers.

ISOLATION TRANSFORMERS FOR PORTABLES PROPOSED TO CHECK SHOCK HAZARDS--An Indiana association voted recently to recommend the installation of isolation transformers on all portable sets to eliminate potential shock hazards. . . . The move was in line with the position taken by the city electrician that portables should include such transformers or they would not be endorsed by the city for public sale.

SERVICE MEN CAUTIONED ON BUILT-IN TV INSTALLATIONS--TV engineers have issued a word of caution to those planning to install TV sets in a wall, warning that heat or fire hazards may obtain if essential air circulation is lacking. . . . TV cabinets, it was pointed out, are built to permit adequate air circulation throughout the interior of the set when operating in an open area. This design serves to provide the necessary cooling action and is absolutely vital for safe operation and long life, provided the set is not placed flush against a wall; such an installation could cut off air circulation and not only impair operation of the set, but create a heat menace. . . . Describing installation practices for built-in TV, engineers noted that chassis should be enclosed in a separate enclosure with a minimum of two inches of air space between the TV cabinet and the enclosure at bottom and rear, and three inches between the enclosure and the top of the set. Adequate grill openings should be provided in front and at the top and bottom of the receiver. This enclosure should be constructed of an approved galvanized material, similar to the standard terminal or junction box, or other approved fireproof material. The set within the box should be supported by metal braces and the power supply should be within the enclosure.

19 PHASES OF AUDIO TO HEADLINE AT AES MEETING IN NEW YORK--The longest convention in the history of the Audio Engineering Society has been announced for the ninth annual meeting, which will take place October 8-12 in the New York Trade Show Building, concurrently with the New York High Fidelity Show, sponsored by the Institute of High Fidelity Manufacturers. . . . The five-day conference will open with talks on disc recording and playback, followed by reports on perception of wow, measurement of disc and tape-frequency responses, and test records. . . . On following days, audio specialists will discuss electronic music, tape duplication, audio transistor applications, FM audio reception, microphones and speech input systems, stereo problems, speakers and enclosures, amplifiers and phono pickups.

INDUSTRY EXPERT FORECASTS BILLION-DOLLAR MARKET IN AUDIO--As a result of the growing interest in better sound, consumers will spend more than a billion-dollars during the next year to enjoy recorded music in the home. So predicted the general manager of one of the largest phono manufacturers in the country recently. . . . By 1958, he said, the fantastic growth of audio will have helped to boost the home-music industry's sales by 200 per cent over a period of five years, while spending for all recreation was rising by only about 17 per cent. . . . In 1953, it was noted, sales of phonos were in the low million-dollar bracket. But in 1954, sales jumped to $43-million, and in 1955 we went to $85-million at retail levels. Last year sales rose to $177-million; now industry anticipates topping the $300-million mark, before the year is over, and hitting a $1-billion sales record within the next twelve months.

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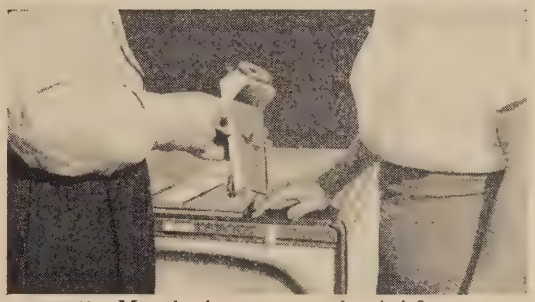
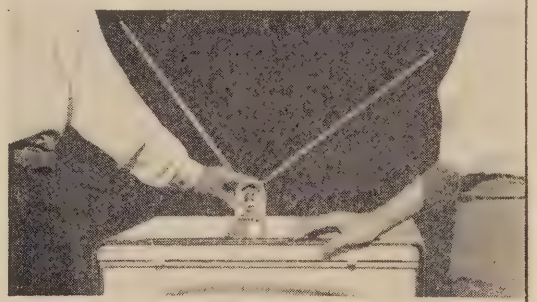
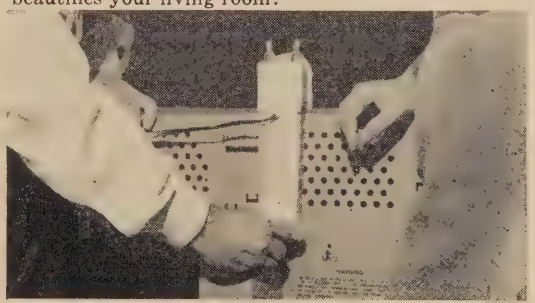
WITH JFD MAGIC GENIE "SHOW'N SELL"



Housewife: My, that's pretty . . . what is it?
Serviceman: It's the new indoor antenna that conceals behind the set like this. See how it gets rid of the old fashioned top-of-the-set indoor antenna and beautifies your living room?



Housewife: Does it really work?
Serviceman: Like a charm. The Magic Genie's printed circuit clarifier and new all-angle turret dipole design brings in such beautiful reception, your family will flip.



Housewife: How much does it cost?
Serviceman: $14.95—a small investment, when you consider the thousands of hours of wonderful TV enjoyment the Magic Genie makes possible.

Housewife: How can I be sure?
Serviceman: The JFD Magic Genie is backed by an unconditional factory money-back guarantee. That's how positive we are of its fabulous performance . . . I'll install it for you.

GET SET FOR A MAGIC GENIE SALES BOOM!

Over 150,000 JFD Magic Genies have been sold by profit conscious service-dealers—and it's only the beginning. Genie profits will rocket to new heights in '58. Order now from your JFD distributor.
Start making $7.75 extra on 7 out of 10 TV service calls.

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TV-Picture Streaking Remedies . . . Silicon-Rectifier Replacements . . . Removing Speaker-Grille Static Charges . . . Phono-Motor Noise Reduction . . .

IF PICTURE streaking after white highlights is encountered in DuMont RA-380/381, the following changes are recommended: C_{227} (input to picture tube) should be replaced with a .22-mfd capacitor, C_{256} (retrace blanking network) should now be a .1-mfd capacitor, and R_{261} (retrace blanking network) should be changed to a 12,000-ohm (10%) resistor.

These changes were incorporated in late production receivers.

IF, WHEN the DuMont Model RA-380/381 is tuned to any high channel (7 to 13) excessive *noise* should appear in the form of streaks on a weak signal, the cause will be found at the 6BN6 sound discriminator tube, which is oscillating at a frequency between channels 7-13.

The cure is to install a 7.5-mmfd capacitor across pins 2 and 5 of the 6BN6 sound discriminator tube. This capacitor has been installed in late production receivers.

ON SOME DUMONT chassis (RA-380/381 and RA-392/393) hiss in the sound has been noted.

Fault here is due to improper setting of *buzz pot* and quadrature coil. Quadrature coil should be readjusted for best sound quality on a weak signal, and *buzz pot* should be adjusted for minimum buzz on a normal signal.

Fringe sound performance on DuMont RA-380/381 models can be improved by adjusting both slugs of L_{204}, the sound takeoff coil, and L_{208}, the quadrature coil. This adjustment can be made easily because these slugs are accessible from the top of the chassis. It has been found that these readjustments should be made only under extremely weak signal conditions to realize a discernible improvement.

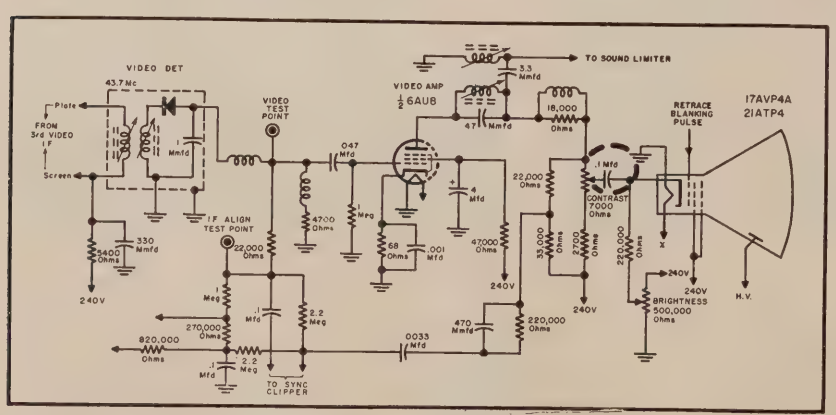


FIG. 1: COMPONENT CHANGES in DuMont RA-380/381 (picture-tube capacitor and retrace-blanking network) to cure picture streaking.

Silicon-Rectifier Production Changes

SILICON RECTIFIERS, providing an increase in the *dc* supply voltage, are now being used in Westinghouse chassis V-2311-63, -65, V-2321-601, V-2370-62, -64, -82, -84, V-2380-601 and -801.

The following changes have been made because of the higher *dc* supply voltage. Electrolytic capacitors C_{507A}, C_{508A}, C_{509A}, and C_{510A} now have a higher voltage rating. The value of the horizontal-output-tube screen-dropping resistor, R_{429}, has been increased to 820 ohms, 1 *w* on 14″ chassis and to 1500 ohms 1 *w* on 17″ chassis. The *hv* filament resistor, R_{431}, has been increased in value to 2.7 ohms on 17″ receiver chassis only.

A silicon rectifier has been found to provide an increase of about 8-10 *v dc* over the selenium rectifier because of the lower voltage drop across the silicon type. The higher available *dc* supply voltage is used to provide slightly higher picture-tube second-anode potential.

Removing Static Charge

IN SOME early production units of the Magnavox MV/U175-316 series one might encounter static charge conditions on the speaker grille. *The charge is in no way dangerous,* but may cause a popping sound during high-voltage buildup and decay periods.

To eliminate this, one should first remove the baffle, glass and mask. Then one end of a piece of metal braid should be stapled to the front of the bottom of the vertical wood separator (between the speaker and the TV compartments), so that when the baffle is replaced the vertical metal trim strip will ground against the braid. The loose end of the braid should be routed to the nearest picture tube mounting bracket and grounded with an adequate solder bond.

Motor-Noise Reduction Change

ON SOME MOTOROLA chassis (models 918 and 919HR) the ground side of resistor R_{16} has been lifted from ground and an 82,000-ohm resistor has been wired in between R_{16} and ground. From the junction of R_{16} and the new 82,000-ohm resistor a .01-mfd ceramic disc capacitor has been wired to pin 2 of the 12AL8 trigger-relay-control-tube. This change has been found to reduce the amount of 60 cycle hum noise which may be introduced in the receiver by a record player.

new!

Simpson 7" COLORSCOPE

MODEL 458

$229.95 complete with shielded input cable and manual

100% response at 3.58 mc colorburst!

DUAL BANDWIDTH—NARROW OR WIDE

Compare the new Simpson Colorscope Model 458 with any oscilloscope on the market. It is an advanced, seven-inch, high-gain, wide-band scope especially designed for color-TV service. (Ideal for black and white, too.) A big feature of the Model 458 is its *flat* frequency response—within 1 db to 4.5 mc! With its accessory probes, Model 458 can do more color-TV testing jobs than any scope in its price range.

ADDITIONAL FEATURES

- Dual bandwidth provides extra testing versatility.
- Properly compensated wide band vertical amplifier stages.
- High sensitivity and very good transient response.
- Compensated step attenuator.
- Vernier vertical attenuator for *continuous control* of the signal voltage.
- CRT balanced deflection.
- Excellent square wave response.
- Very small loading of circuit being checked.
- "Tilt" and "Overshoot" carefully checked and minimized.
- Very stable sweep and synchronizing circuits.

ACCESSORY PROBES

Voltage Doubler, No. 740 . . $10.95

Low Capacitance (input impedance of 10 megohms shunted by only 14 mmf), No. 741 . . $9.95

100:1 Voltage Divider, No. 742 . . . . . $9.95

Direct-Resistive Dual Purpose, No. 743 . . . . . $9.95

SPECIFICATIONS

VERTICAL AMPLIFIER FREQUENCY RESPONSE—Wide band position: *Flat* within ± 1 db from 20 c/sec to 4.5 mc/sec; *flat* within ± 2 db from 10 c/sec to 5.0 mc/sec.

Narrow band position: *Flat* within ± 1 db from 20 c/sec to 200 kc/sec; *flat* within ± 2 db from 10 c/sec to 300 kc/sec.

RISE TIME—Less than 0.05 microsecond (wide band position).

VERTICAL DEFLECTION SENSITIVITY—Wide band: 40 mv R.M.S./inch minimum. Narrow band: 15 mv R.M.S./inch minimum.

HORIZONTAL AMPLIFIER FREQUENCY RESPONSE—*Flat* within ± 1 db from 20 cycles/sec to 200 kc/sec.

HORIZONTAL DEFLECTION SENSITIVITY—Horizontal input "Hi", 115 millivolts R.M.S./inch minimum. Horizontal input "Low", 1.4 volts R.M.S./inch minimum.

VERTICAL INPUT IMPEDANCE—3.3 Megohms shunted by 20 mmf.

HORIZONTAL INPUT IMPEDANCE 1.1 Meg.

LINEAR SWEEP OSCILLATOR—Saw tooth wave from 14 cycles/sec to 250 kc/sec. Sixty-cycle sine wave also provided.

INPUT CALIBRATION—18 Volt P-P test voltage available on panel.

INTENSITY MODULATION—Provision for internal, external and 60 cycles.

See Your Electronics Parts Distributor, or write

SIMPSON ELECTRIC COMPANY
WORLD'S LARGEST MANUFACTURER OF ELECTRONIC TEST EQUIPMENT
5200 W. Kinzie St., Chicago 44, Illinois
Phone: EStebrook 9-1121
In Canada: Bach-Simpson Ltd., London, Ontario

UHF-VHF TV ANTENNA DIGEST

DESIGN • APPLICATION • INSTALLATION • SERVICE

TV Antenna Tower Installation‡

TOWER-MOUNTED bay-antenna systems are still not only the key to black and white reception in a number of deep-fringe communities, but in even less remote areas for color-TV pickup to insure consistent signal levels.

In the main, two types of towers are in use today; the self-supporting mast (which can rise up to 50′ without support) and the guy-mounted tower now available in heights up to 100′ to 200′; the 100′ to 200′ towers may be available soon in self-supporting styles.

The 50′ self-supporting towers are very popular because they require little mount area and can usually be placed alongside a house, using a simple bracket for support, as illustrated in Fig. 1.

The tower shown, electroplated with zinc, features welded load bearers designed to take the strain off the joints; the joints are of the free-drainage type to prevent trapped moisture and corrosion. In addition, the tower uses grid-around cross ties to provide a grip around the outside of the vertical tubing, minimizing vertical stress and removing the outward strain to add strength to the antenna support atop the tower.

Towers of this type are usually supplied in 10′ sections and joined together with 4000 pound (*psi*) bolts.

To minimize vibration, the house brackets use rubber cushion blocks within heavy steel U-straps.

In the installation shown in Fig. 1, *vhf*[1] and *uhf*[2] antennas were mounted atop the 50′ tower to provide reception from Illinois and Indiana areas.

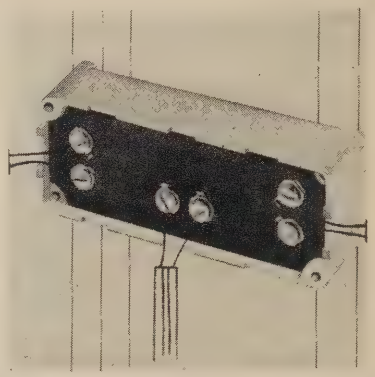
‡*Based on information supplied by* ***Bernard Lindsay****, Mattoon, Ill., and* ***Paul I. Harshman****, KTV Tower and Communication Equipment Co.,*

(Left)

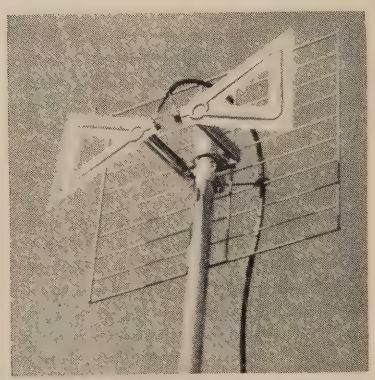
FIG. 1: VHF-UHF ANTENNAS mounted atop a 50′ self-supporting tower in a Mattoon, Ill., installation.

[1]*JFD Jet* 213

[2]*TACO* 3034C



MULTI-SET COUPLER available in 2 and 4-set styles for strong-signal and fringe areas. Universal mounting is said to permit installation of couplers indoors, (on the baseboard, in the attic or basement) and outdoors, (on the antenna mast or on the side of the house). (Jerrold Electronics Corp., 23rd and Chestnut Sts., Philadelphia, Pa.)



UHF BOWTIE antenna for use in prime service areas. Features air-dielectric design, dipoles being suspended by means of a bracket assembly. Reflector is said to be welded; screen is coated with a protective finish. Stacking lines are available for tandem assemblies where additional gain is required. (Model 3011; Technical Appliance Corp., Sherburne, N. Y.)

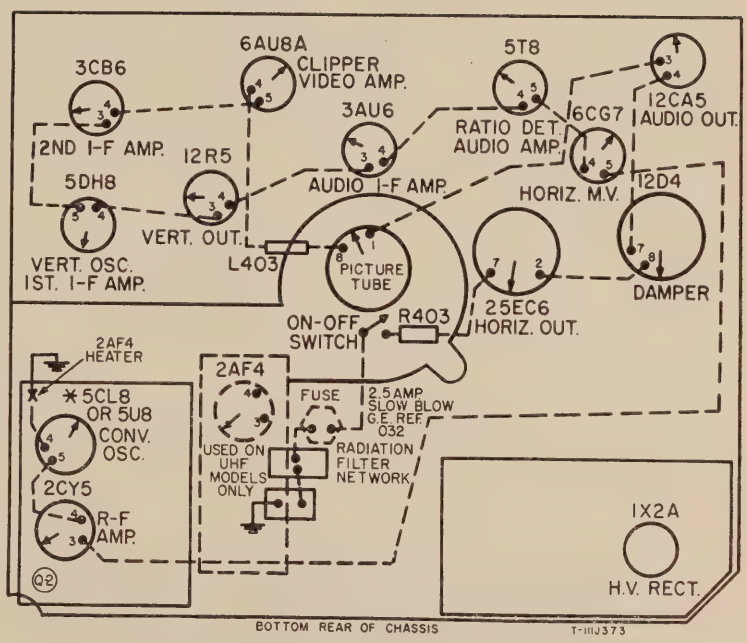
How filament wiring charts can save you time and work servicing **HOTPOINT PORTABLE TV**

Fast Tube Test Without Testing Each Tube!

This year, all Hotpoint Portable TV receivers have Filament Wiring Charts printed right on the inside of the cabinet back.

Since these Hotpoint models have tube filaments connected in series, an open filament in any tube would make all the tubes appear inoperative. But now you can quickly spot the ailing tube. The dashed lines on the Filament Wiring Charts (at right) indicate wiring connections to the tube filament pin numbers. And each tube is keyed to give the exact location of the filament pin numbers just as you see the tubes when the back is removed.

By using these charts and an ohmmeter, you can check resistance before and after each tube in the series and quickly uncover the tube with an open filament.



1958 Hotpoint Portable TV—Q2 Chassis only (for M3 Chassis, see chart inside of cabinet back)

EXAMPLE: Assume the filament of the 2nd IF tube in the Q2 chassis is open. To test:

1. Remove the power plug from wall power outlet and turn "ON-OFF" knob to "ON" position.

2. Connect one lead of an ohmmeter to chassis ground.

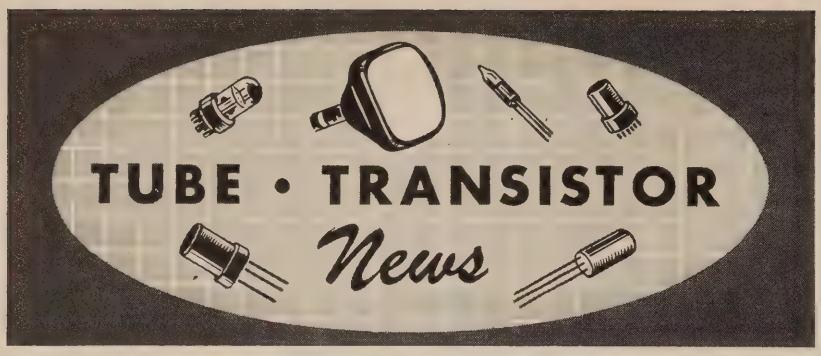
3. With the other probe of the meter, check the resistance to ground at each of the tube filaments by following the dashed lines starting from the A. C. interlock socket. At all points measured prior to pin 4 of the 2nd IF tube, infinite resistance would be indicated on the meter. At pin 3 and each succeeding tube, the reading would be zero. SINCE THERE IS CONTINUITY FROM PIN 3 OF THE 2nd IF TUBE TO CHASSIS GROUND, IT IS EVIDENT THAT THE FILAMENT OF THIS TUBE IS OPEN.

Use this easy procedure to save time and work servicing HOTPOINT Portable TV.

Another service to Servicemen from

Hotpoint Hi-Vi TV

Hotpoint Co., A Division of General Electric Company, 5600 West Taylor Street, Chicago 44, Illinois



Replacement Tubes For 110° Chassis . . . Latest Developments In Audio, FM Tuner And Auto-Radio Tubes, And Semiconductors

THREE 110° replacement picture tubes in 14, 17 and 21-inch sizes, (14ASP4, 17BZP4, and 21CEP4) are now available.[1]

The 14ASP4, a 110° direct view, rectangular face, electrostatic focus and magnetic-deflection picture tube, employs a spherical filter-glass face plate with a metal-backed (aluminized) screen. Gun design eliminates the need for an ion-trap magnet.

The 17BZP4, another 110° direct-view, rectangular face, electrostatic focus, and magnetic-deflection picture tube type, is also aluminized, and has a spherical filter-glass face plate. No ion trap is needed for this tube either.

The third 110° tube, the 21CEP4, is also an aluminized rectangular model with electrostatic focus and magnetic deflection, which does not require an ion trap.

TV RF Amplifiers

FOR RADIO-FREQUENCY amplifier replacement in vhf TV tuners, miniature heater-cathode type medium-mu triodes (3BN4) have been developed[1]. The 3BN4 is identical to the 6BN4 except that it has a 450-*ma* heater rating.

Also now being made for replacement[1] is a miniature heater-cathode type beam-power pentode (6AQ5A) for the *af* power output stage of radio and TV receivers. The 6AQ5A, which may also be used as a triode-connected vertical-deflection amplifier in TV chassis, is identical to the 6AQ5 except that it has a 450-*ma* heater rating.

[1] *Raytheon.*

Audio Amplifiers

A MINIATURIZED audio amplifier tube[2], the Genalex KT88, has been designed. A pair of these tubes, it is claimed, with a plate supply of 560 *v* and fixed bias, can provide an output of 100 watts.

Also recently announced for audio is a high-perveance beam power tube (6973) of the 9-pin miniature type, designed for use as a power amplifier.[3]

In push-pull class AB1 audio service, two 6973's operating at a plate voltage of 350, grid-No. 2 *v* of 280 and fixed grid-No. 1 *v* of −22, can deliver, it is said, a maximum-signal power output of 20 watts with a total harmonic distortion of 1.5 per cent.

FM Tubes

TWO GENERAL-PURPOSE high-mu twin triodes (6DT8 and 12DT8) of the 9-pin miniature type, intended for use as *rf* amplifiers, and as combined oscillator-mixers in FM tuners, have also been introduced recently[3].

The two units of each type are isolated from each other by an internal shield having a separate base-pin terminal. This shielding arrangement, it is said, enables circuit designers to achieve substantial reduction in antenna radiation, providing stable performance in high-frequency applications.

Auto-Radio Diode-Triodes

MINIATURE DOUBLE-DIODE TRIODES, designed for 12-*v* hybrid auto sets, are now available as replacements.[4]

Designated type 12AJ6, the 7-pin miniatures are a combined double triode detector and high mu triode. The triode section is intended for use as an *af* voltage amplifier where heater and plate potentials are obtained directly from an automotive battery.

[2] *British Industries; manufactured by G. E. England.* [3] *RCA.* [4] *Sylvania.*

Send for FREE SAMPLE PACKET of the three new
MUELLER "70 SERIES" ALLIGATOR CLIPS
Low-cost, streamlined clips
with SNAP!
THIS IS AN ACTUAL
HIGH SPEED SEQUENCE PHOTOGRAPH
OF A NEW "70 SERIES" ALLIGATOR CLIP
which is taking 1/2500th second to snap shut upon a wafer. Talk about acceleration! — the upper jaw hits 60 MPH in three-eighths of an inch. The upper jaw and flying wafer fragments have been caught in many images along their paths of movement.
Photographed by means of a special process, it graphically illustrates the "snap" in Mueller's traditionally snappy springs. These springs provide a mean, corrosion-cutting bite for perfect test connections.
THE NEW "70 SERIES" ALLIGATORS FEATURE:
Simple, direct, streamlined design, and lower cost than the famous "60 Series".
Faster, easier connection, whether screw type or soldered.
A new patented hinge, and cord strain relief ears.
WRITE FACTORY TODAY FOR FREE SAMPLE PACKET SHOWN ABOVE
MUELLER
Full Size
Mueller Electric Co
1573Y East 31st Street • Cleveland 14, Ohio

6-V 2-Way Conversion

(*Continued from page* 35)

fluctuation during tuning procedures, normal operation of the sets, aging of final amplifier tubes, and other factors, it will be found best to replace the dynamotors with 12-*v* units of equivalent output rating. It might be remotely possible to work out a system using a dropping resistor; however, far better service efficiency will result when the dynamotor is replaced.

The final conversion step is in the relay section. In most of the two-way chassis four relays are used; a heavy duty solenoid type for starting the dynamotor (similar to the familiar electric starter solenoids used on all cars), keying relay, antenna relay, and a small switching relay, which control all current applied to the set, except for the dynamotor primary current.

A study of the circuitry will disclose the fact that the keying relay, antenna and dynamotor-starting relays are all fed from a common line. Therefore, it is simple to open this line, and measure the total current drawn by the three relays.

They all close simultaneously, the keying relay being actuated by the microphone switch and the remaining two by the keying relay. Therefore, only one resistor will be needed to apply the correct voltage to all three. Actual current measures 1.5 amperes and accordingly a 4-ohm resistor will be needed. This will provide nearly 6 *v* on each relay; in actual operation, these relays are closed only momentarily and a small over-voltage condition will not harm them.

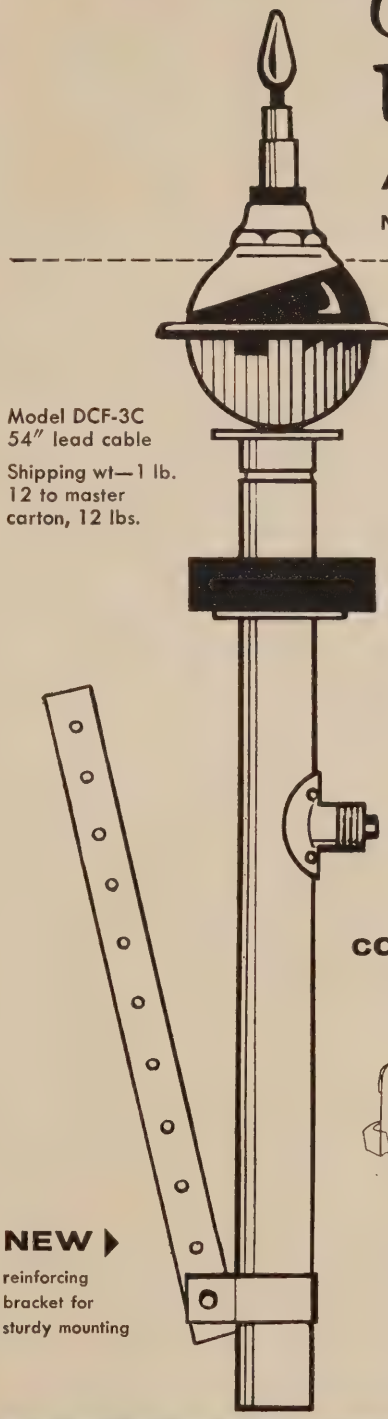
The remaining relay can be located in a fuse-box, installed under the hood, and controlled by an on-off switch in the control head; a single 15-ohm resistor can drop the voltage applied to it.

The resistors used in the various circuits must be able to withstand the wattage load imposed upon them, and the allowance of a large safety factor is imperative. In the conversion just discussed, resistors used were all 10-watt enameled types, except for the adjustable 25-watt unit in the receiver power supply.

Because of their physical size and weight, and also because of the heat dissipated, each resistor should be mounted on its own individual terminal strip, with sufficient clearance above the chassis to avoid proximity to adjacent parts to prevent heat damage to them.

Ward's New Complete Disappearing AUTO ANTENNA

MODEL DCF-3C



Model DCF-3C
54″ lead cable
Shipping wt—1 lb.
12 to master
carton, 12 lbs.

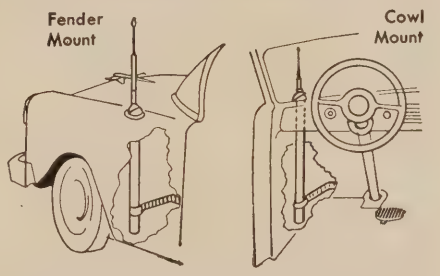
NEW flame tip for streamlined appearance and better reception.

NEW water-seal grommet for double fender...the *ONLY* disappearing antenna specially designed to fit Chevy and other cars with double fender.

NEW lightweight aluminum shield tube for easier handling and better reception characteristics.

NEW lead take-off for much easier installation.

COLLAPSES FROM 45″ TO 1″



NEW reinforcing bracket for sturdy mounting

It's a new, fast-selling model; car owners will demand on sight. Makes car washing easier. Adds a top-quality appearance to any car. Avoid disappointment—order *NOW!*

Ward PRODUCTS CORP.

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IN CANADA, ATLAS RADIO CORPORATION • 50 WINGOLD AVE • TORONTO, ONTARIO

Service Engineering

(*Continued from page 37*)

this requirement. The fixed-tuned types are generally multi-channel instruments tuned for specific frequencies only. For example, a four-channel frequency meter may be set up to check transmitters on any four frequencies within the frequency range of the instrument. When a shop services equipment for several customers and requires means for measuring more than four different frequencies, additional fixed-tuned frequency meters or a continuous tuning frequency meter may be provided. Some of the frequency meters also measure frequency deviation of FM transmitters during modulation.

The FCC is concerned only with transmitters, but the customer is vitally concerned with receiver performance. Communicating range is more directly related to receiver performance than transmitter power output. A *hot* receiver can pick up signals radiated from a feeble transmitter, but a misaligned receiver or one with a bad tube can reject a signal from a quarter-kilowatt transmitter a mile away.

An experienced *service engineer* can align a receiver using an electric razor as a signal generator. The same man can probably diagnose troubles with a wet-finger voltmeter. But both jobs can be done better with the proper test equipment.

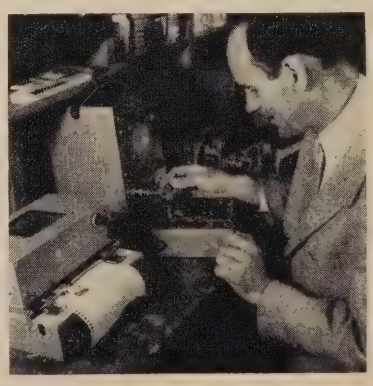
One of the most important pieces of test equipment required in the two-way shop is the *vhf* signal generator. While most of the popular signal generators intended for TV and home receiver servicing, which are tuneable through the 25-50 and 152-174 mc bands, either on a harmonic or fundamental basis, might seem adequate, very few will fill the bill for two-way.

The *vhf* signal generator must be capable of having its output attenuated to a fraction of a microvolt. Even if the output level controls permit this, enough signal may look through the signal generator housing to saturate the receiver being serviced. The typical two-way receiver operates satisfactorily with a signal of less than one microvolt.

There are several suitable *vhf* signal generators on the market. The signal generator should be provided with means for frequency modulation of the signal. Both FM and AM receivers may be aligned to an FM signal. To be really up to date, the signal generator should tune through the 450-470 mc *uhf* band, as well as the 25-50 and 152-174 mc bands.

The tuning dial calibration of even the best signal generators is seldom accurate enough, nor is the frequency stability. Therefore, it is desirable to have a crystal-controlled marker generator available, to which the tuneable signal generator may be zeroed. In the absence of a marker generator, a signal from a station on the same frequency may be used as a reference for setting of the signal generator.

The service manuals supplied by two-way equipment manufacturers generally spell out the recommended



GRAPHIC RECORDER (a useful instrument in the shop for observing intermittent conditions) and grid emission tester in a 2-way shop. (Courtesy Varian and Seco)

ATTENTION: People who service 2-way Communications

One day!

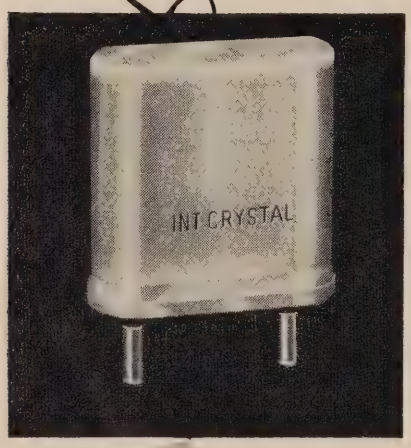
PROCESSING

F6 Series Crystals

for

STANDARD 2-WAY

Equipment in Commercial Use



Wire mounted plated crystals for use in commercial equipment where close tolerances must be observed. All units are calibrated for the specific load presented by equipment.
HOLDERS: Metal, hermetically sealed.
CALIBRATION TOLERANCE: ±.0025% of nominal at 30° C.
TOLERANCE OVER TEMP. RANGE: ±.002% from −30° + 60° C.
CIRCUIT: As specified by customer. Crystals available for all major 2-way equipment. (In most cases the necessary correlation data is on file).
DRIVE LEVEL: Maximum— 10 milliwatts for fundamental, 5 milliwatts for overtone.

F-605		F-609		F-612	
Pin dia.	.050	Pin dia.	.095	Pin dia.	.125
Pin length	.238	Pin length	.445	Pin length	.620

HOW TO ORDER:

Specify • Channel Frequency • Holder Type* • Circuit Data (32 mmf load, series resonance, etc.) • End Use (Equipment type and manufacturer, development, etc.)

*Adaptors can be supplied for ¾" pin spacing.

Orders of 5 Units or Less Air Mailed Within One Working Day!

FREE!
1957 CATALOG ---
Send for YOUR Copy..Now!
Specify Catalog S9-57

International
CRYSTAL MFG. CO., Inc.
18 N. LEE OKLAHOMA CITY, OKLA.

TWO-WAY shop with assortment of instruments required for servicing two-way equipment: vhf signal generator (center), test meter (on top of the signal generator), dc vtvm and ac electronic millivoltmeter whose scale is being set by the service engineer. (Photo by Cyril Glunk)

alignment technique for specific models.

In some cases, limiter voltage is metered during the alignment procedure with a *dc vtvm*. Trimmers are adjusted for maximum limiter voltage. Sometimes, the alignment indicator may be an *ac* voltmeter across the audio output of the receiver. For this purpose, an *ac vtvm*,[2] which will measure audio and *rf* signals down to 20 microvolts and up to 300 volts, may be used.

This instrument, which is transistorized and battery operated, offers the advantage that it may be used in the field as well as in the shop. Furthermore, the fact that it does not plug into the *ac* line frees it from 60-cycle beating.

Most two-way receivers may be aligned using an *ac* or a *dc vtvm* as an indicator, but some mobile units[3] require the use of a 'scope. Any other means leads to unsatisfactory results.

---

[2]*Like the Fisher VT-3.* [3]*Philco.*

TWO-WAY transmitter frequency being checked with an electronic counter (at the right). (Courtesy Hewlett Packard)

Purpose	Instrument	Range
Frequency Measurement	Tuneable or fixed-tuned frequency meter(s) or secondary frequency standard	25-470 mc; may require several instruments to cover range
Frequency Deviation (FM)	Deviation meter or combination frequency-deviation meter	0-25 kc
Modulation Percentage (AM)	'Scope or percentage modulation meter (or *rf* wattmeter)	0-100%
Power Output	*RF* wattmeter	0-50/500 *w*
Tuning	*RF* wattmeter and tuning meter	0-50/500 *w*; special
Tube Quality	*RF wattmeter*	0-50/500 *w*
Diagnosis	*DC vtvm*	Up to 1000 *v*
	AC vtvm	20 *mv*/*v*–300 *v*

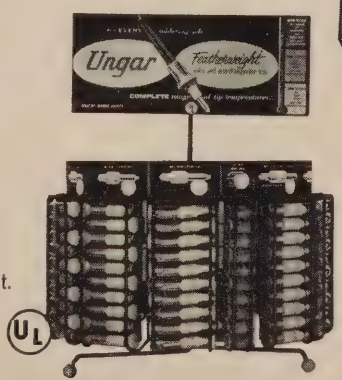
TWO-WAY transmitter test equipment.

88% OF RADIO AND TV SERVICE MEN NOW USE UNGAR SOLDERING IRONS

16 Interchangeable Tips and Tiplets from 23½ to 47½ watts — 700° to 1000° F. Tip Temperature

This feather-light pencil soldering iron with its 16 interchangeable tips and tiplets will handle every soldering assignment from large metal parts such as chassis to delicate printed circuit work. An UNGAR No. 535 is a must for Printed Circuit Repair. Write for special booklet on Printed Circuits — FREE.

Better jobbers everywhere handle this Ungar iron and display it with 16 interchangeable tips and tiplets in this counter dispenser. Look for it.



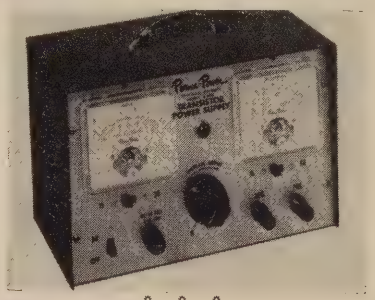
Ungar ELECTRIC TOOLS, INC. 4101 Redwood Avenue, Los Angeles 66, Calif.

TEST INSTRUMENTS

TRANSISTOR POWER SUPPLY

A TRANSISTOR-POWER supply, *A*-400, for servicing and testing transistor portable radios, amplifiers, phonos and similar equipment, has been introduced by Perma-Power Co., 3100 N. Elston Ave., Chicago 18, Ill.

Supply is said to eliminate battery stocking and need for additional low current metering. Ranges of 0-15 *ma,* 0-60 *ma,* and 0-15 *v* and 0-30 *v* cover both transistor and hybrid equipment with 2% accuracy.



PORTABLE TUBE AND TRANSISTOR TESTER

A PORTABLE DYNAMIC-MUTUAL conductance tube and transistor tester, 650 *Dyna-Quik,* for testing tubes under operating conditions in the home, has been announced by B&K Manufacturing Co., 3731 N. Southport Ave., Chicago 13, Ill.

Tests each section of multiple tubes separately for GM, shorts, grid emission, gas content and life. Shows tube condition on *good-bad* scale and in micromhos. Included on panel are 7 and 9-pin straighteners.

Transistor tester checks leakage current (I_{co}) and forward gain ratio of junction, point contact and barrier transistors. Measures front-to-back ratio of germanium and silicon diodes, and of selenium and silicon rectifiers on meter percentage scale.

A BATTERY ELIMINATORS

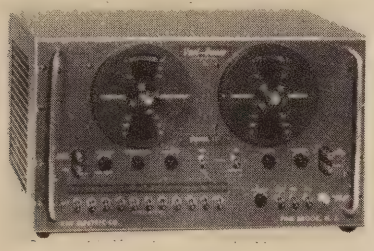
A BATTERY ELIMINATORS, for use with transistor or vibrator-operated auto-radio sets, have been announced by American Television and Radio Co., 300 E. Fourth St., St. Paul 1, Minn.

Units provide 6 and 12 *v dc* output operation and feature 8-position voltage-control voltmeter, ammeter and automatic operation.

FIXED-BAND ALIGNMENT UNIT

An alignment instrument, *Vari-Sweep* 866, providing continuously variable center frequency from 4 to 120 *mc* with direct readings from an individually-calibrated frequency dial, has been developed by Kay Electric Co., 14 Maple Ave., Pine Brook, N. J.

Tester provides continuously variable sweep widths from *kc* range to as high as 40 *mc* and a continuously variable frequency marker from 2 to 135 *mc* giving separate direct readings from an individually-calibrated frequency dial. Marker is a *birdie-pip* type combined with a sweeping oscillator output within the unit. All coupling is provided within the unit and variable marker is isolated from the *rf* circuits under test.



* * *

'SCOPE PREAMPLIFIER

A 'scope preamplifier, *SPR-100*, said to increase 'scope sensitivity by 40 db without adding substantially to hum or noise content, has been announced by Jerrold Electronics Corp., 23rd and Chestnut Sts., Philadelphia 3, Pa.

Said to be useful in measuring or adjusting *rf* circuitry where signal levels are relatively small, as in a single interstage network of *if* or *rf* amplifiers or in observation of *stop-band* characteristics of filters and cavities. Features marker-insertion circuitry, which permits use of a *pip-type* marker presentation; a built-in *rf feed-through* type detector; and a high-pass filter section that can be *switched in* to facilitate *vswr* measurements.

* * *

RADIO-TV TEST INSTRUMENTS

Three test instruments—a *dc* microammeter, *rf* signal generator and a video test adapter—have been announced by the RCA Components Division, Camden, N. J.

Microammeter, *WV-84B*, is a battery-operated vacuum-tube unit, featuring 6 *dc* ranges from .0002 to 1000 *ma*.

Signal generator, *WR-49B*, is a portable service unit for uses requiring a modulated or unmodulated *rf* sine wave between 85 *kc* and 30 *mc*. It provides calibrated signals in 6 bands with or without audio modulation and a built-in attenuation range of 65 db. Features burnout protection, plus full-length shielding of output cables for minimized radiation and hum pickup.

The video test adapter, *WG-306B*, is a plug-in adapter for troubleshooting video output stages of color-TV receivers. Device makes it possible to inject video signals from adapter directly into control-grid circuit of video-amplifier stages. For use in sets using either 6CL6 or 12BY7A tubes.

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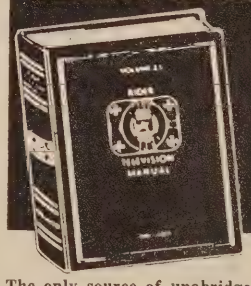

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AUTO ANTENNAS

TOP/SIDE-MOUNTING AUTO ANTENNA

AN AUTO ANTENNA, *Bullet*, with a swivel base to permit top or side mounting, has been introduced by The Tenna Manufacturing Co., 7580 Garfield Blvd., Cleveland 25, Ohio.

Available in six models with vertical or angular masts for front or rear mounting: Single rear active, single dress-up, dual rear active, dual one active, front vertical and front angular. Extra mounting pad is packed with each antenna for mounting on high-crown surfaces.

* * *

CHAIN-TYPE BUMPER MOUNT ANTENNA

A CHAIN-TYPE BUMPER mount antenna, *M-2*, for attachment to car bumpers without drilling holes, has been introduced by Antenna Specialists Co., 12435 Euclid Ave., Cleveland 6, Ohio.

Chain bumper mounting, spring and whip are available separately. Spring (M-3A) designed for use with bumper mount, is said to bend through a 100° arc without disturbing performance.

* * *

CAR-RADIO ANTENNA/BOOSTER LINE

A LINE OF AUTO-RADIO antennas, *Fidelitrend* for cowl, rear deck and dual-fender mounts, has been announced by Electrend Products Corp., State and Water Sts., St. Joseph, Mich.

Coiltenna, basic power pack, is an integral part of all models. Units are available complete with mount and cable, or as replacements, using existing mount and antenna stub.

* * *

REAR-DECK ANTENNA

A REAR-DECK AUTO ANTENNA, designed to fit the high-finned cars, is now in production at Snyder Manufacturing Co., 22nd and Ontario Sts., Philadelphia, 40.

The new model, *Shark*, can be installed on the front fender (model TC-17) or can be mounted on the trunk lid (model TC-17T); can also be used as a single rear deck or dual rear deck antenna (RD models).

Antenna, a 3-section unit which extends from 13½" to 27", comes with coax cable harness and two plastic base insulators to fit all fender contours.

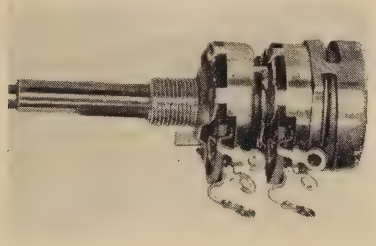
NEW ALUMINUM TUBING PRODUCTION FACILITIES

HIGH-STRENGTH ALUMINUM TUBING slitting, rolling and electronic welding equipment recently installed in JFD plant 1. High speed Morvay precision slitter serves to cut automatically aluminum wide-width coiled sheet into a quantity of narrow strips at the rate of 400′ per minute. The strips are then fed to an Abbey Etna roll former which, in combination with a Thermatool electronic welder, roll forms and continuously welds the aluminum into round or square tubing at the rate of 275′ per minute.

COMPONENTS

SNAP-TOGETHER DUAL CONTROLS

SNAP-TOGETHER DUAL CONTROLS, featuring concentric design to allow assembly on custom units, have been announced by P. R. Mallory & Co., Inc., 3209 E. Washington St., Indianapolis, Ind. Complete specifications and information are available from distributors.

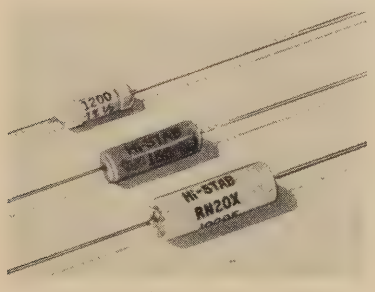


* * *

HIGH STABILITY RESISTORS

DEPOSITED CARBON HIGH-STABILITY resistors, *Hi-Stab*, in molded, non-insulated and hermetically-sealed ceramic encased types, have been developed by Erie Resistor Corp., 644 W. 12th St., Erie, Pa.

Units are said to be suited for low-noise applications and installations in which high stability with low inductance is essential, such as communications, instrumentation, and radio, TV and hi-fi chassis.

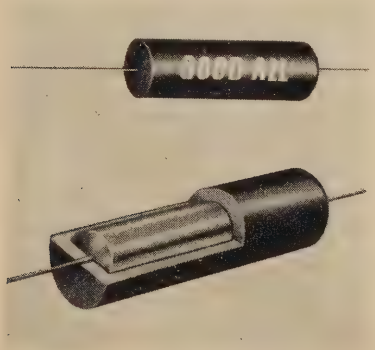


* * *

MYLAR DIELECTRIC CAPACITORS

MYLAR DIELECTRIC CAPACITORS, 600-*UE*, molded in Epoxy, said to have low leakage and high stability in humid climates, have been developed by Good-All Electric Manufacturing Co., Ogallala, Neb.

A self-service merchandiser, *capacitor tree*, with 43 popular value capacitors is being used to introduce this line.



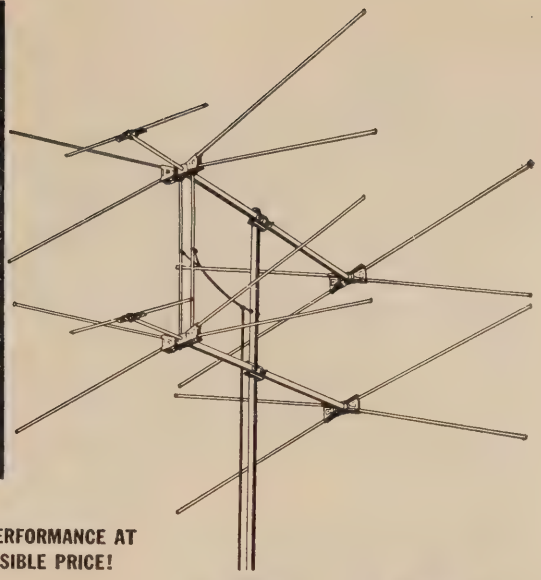
LZX 280SW (shown right)
- QUICK-RIG design for speedy one man installation . . . Brand NEW!
- Double stacked array PLUS high frequency elements.
- All Aluminum Construction.
- Mounts on any mast up to 1¾"
- Complete with stacking bars.

(not shown)

LZX 180SW . . . same as 280SW (single stacked)

LZX 180 . . . QUICK-RIG 8 element "Mighty-X" Conical.

LZX 280 . . . QUICK-RIG double stacked "Mighty-X" Conical.



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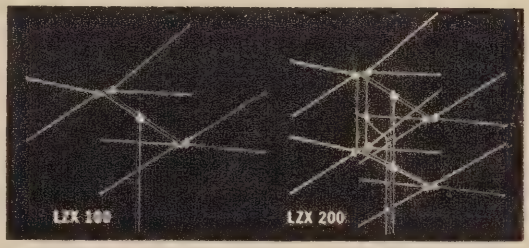
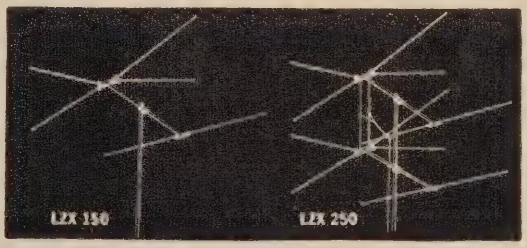
12 new C-D TV antennas

Carefully tested under all conditions . . . each of these new models is guaranteed to be the best performing at the lowest possible price. QUICK-RIG . . . snap!! and its up.

LZX 100 single array
LZX 101 single array, unassembled
LZX 200 8 element conical assembled, stacked array
LZX 201 8 element conical unassembled, stacked array
LZX 150 single array
LZX 151 single array, unassembled
LZX 250 6 element conical assembled, stacked array
LZX 251 6 element conical unassembled stacked array





CORNELL-DUBILIER

Plants in South Plainfield, N. J.: New Bedford, Worcester and Cambridge, Mass.: Providence and Hope Valley, R. I.: Indianapolis, Ind.: Sanford, Varina and Fuquay Springs, N. C.: and Venice, California. Subsidiary: The Radiart Corporation, Cleveland, Ohio.

BENCH-FIELD TOOLS

CLUTCH-FACING KIT

A KIT OF CLUTCH-FACING material to eliminate slipping manual tuners on push-button-tuned auto radios, has been announced by Colman Tool and Machine Co., 1017 N.E. 3rd Ave., Amarillo, Tex.

Kit contains cleaning swabs and two solvents for removing old cements from clutch plates and 25 assorted die-cut clutch facings (in a plastic box) to fit Delco, Ford, Mercury and Lincoln auto radios. Facings are self-sticking adhesive-backed cork and rubber composition.

CONTACT CLEANER-LUBRICATOR KIT

A CONTACT CLEANER-lubricator kit, *ContaCare*, designed to end oxidized contacts in TV tuners, has been announced by Standard Coil Products Co., Inc., 2085 N. Hawthorne Ave., Melrose Park, Ill.

Kit consists of a sulphur-free oil, which is said to clean contacts without leaving residue which causes new oxidization, and special cleaning cloths.

Cures For Hum Pickup And LF Distortion In Amplifiers . . . How To Eliminate Hum In A Tuner - Preamp - Amp System . . . Use Of Regulated Power Supply To Improve Amplifier Performance

OFTEN, ONE ENCOUNTERS severe hum in the pickup input which does not show up until the stylus is lowered into the record groove.

Induced hum from the motor, which probably is immediately underneath the turntable, might cause this condition. To check this we must determine whether the hum comes up when the pickup is lowered, or only when the stylus enters the groove. Some cases have been found where the hum is purely mechanical. It can be transmitted by vibrations in the turntable that usually originate with a poor bearing in the drive motor.

With modern microgroove records, the amount of vibration in the turntable can be so low that you can't feel it when you touch the center spindle, or any other part, and yet a noticeable hum can be developed from the output of the system when the pickup is lowered into the groove. However, if the drive is via a jockey pulley or a belt, you will notice considerable vibration if you touch the bearing of the motor itself.

If this is the cause of the trouble, the best cure is a replacement motor, or at least bearing replacement.

LF Distortion Cures

Amplifiers can show considerable distortion of the low frequencies even though frequency-response checks out quite flat, voltage checks seem to agree with the test chart at all points through the amplifier, and all tubes are satisfactory.

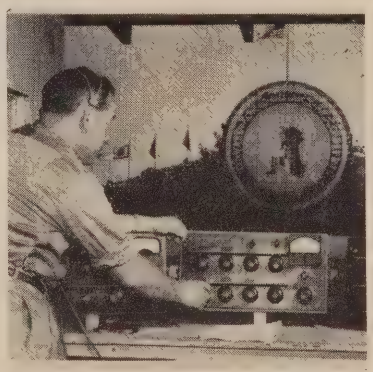
This trouble, common in feedback amplifiers, is usually due to an open-circuit coupling capacitor, somewhere in the earlier part of the amplifier, or a coupling capacitor which has become partially open-circuit, maybe having only about 1/10 or less of its nominal value.

With the old-fashioned amplifier, having no feedback, this would have resulted in extremely *thin* reproduction, because the bass would not have been coupled at all and only the high frequencies would have got through by the stray coupling. The use of conventional overall feedback corrects this deficiency when such a fault occurs, but introduces another.

At the high frequencies the amplifier is functioning more or less normally with the small amount of coupling capacitance that is there. But at the low frequencies, the response is being leveled off by the removal of feedback. The fact that the amplifier gain drops off at low frequencies, due to the capacitor failure, is compensated for by the feedback. This means that the overall feedback, which is effective at the higher frequencies and normally cuts down the input voltage by a ratio of at least 10 to 1, is not operative at the low frequencies.

Not only is feedback no longer available to reduce distortion of the low frequencies, but one of the earlier stages in the amplifier (that is, one of the tubes before the defective coupling capacitor) is now running into serious overloads at low frequencies, because this part of the amplifier gets more than 10 times its normal low-frequency level.

As the capacitor has an open circuit, or is low in value, and is not leaky, it will not upset any of the operating voltages, and everything will appear to be in order until you try to play programs through the amplifier. Bridging each capacitor in the circuit, suspected of the defect, with a new component of the same value, should identify the faulty component and resolve the problem.



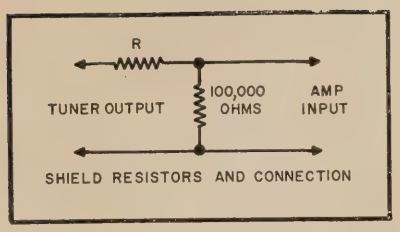
AT CONTROLS of a sound system used to enable scouts in an outdoor amphitheatre at Valley Forge to hear National Jamboree programs presented on a giant stage, the size of a football field. System included a general public-address setup using sixteen stage microphones and sixteen 5½' reentrant horns with 35-watt speaker-driver units. System was powered by four pairs of 70-watt power amplifiers and controlled through a master console featuring twenty-four inputs. The system also provided a special bridging output for feeding audio to television newsreel and radio station sound-recording equipment. (RCA.)

Eliminating Tuner-Preamp-Amp Hum

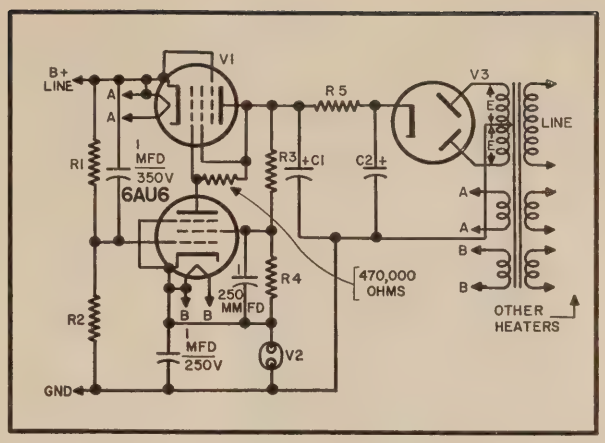
IN TUNER-PREAMP-AMP combinations, one often finds that reproduction improves when the preamp is omitted; however, hum appears when the volume is turned down low.

This type of trouble usually occurs when the main amplifier has no gain control. This means the volume is controlled when going through the preamp, by means of the preamp volume control and, when going straight from the tuner to the main amplifier, by means of the tuner volume control.

Since, in the tuner there are usually two audio stages following the volume control, any hum generated by these stages goes straight into the main amplifier and there is no opportunity to attenuate the hum. When one



(Left)
FIG. 1: PADDING DOWN to eliminate hum when a tuner is fed directly to an amplifier. R=resistor value to be selected.



(Right)
FIG. 2: CIRCUIT FOR a regulated power supply for power amplifiers. Values to suit different voltage and current requirements are given in table 1 below.

operates the tuner through the preamp the tuner's volume control is normally all the way up; thus the hum generated in these stages is attenuated down by the gain control in the preamp. When the controls are turned down for quiet program play, hum generated by the tuner is turned down in the same proportion as the program.

But when the amplifier is connected directly to the tuner, the output volume from the demodulator is decreased, but this does not reduce hum that comes in after the demodulator. Improved quality may be due to any of a number of reasons; the mere fact that less stages are involved means that there is less possibility of distortion; also since the last two stages of the tuner are not operating at full power the possibility of distortion in these two stages is reduced.

But, to reduce the hum when the tuner is tied directly into a power amplifier, a resistance network should be connected in as shown at Fig. 1, so that full volume requires the tuner volume control to be all the way up. These resistances will attenuate the output from the tuner just enough to minimize the hum when volume is turned down.

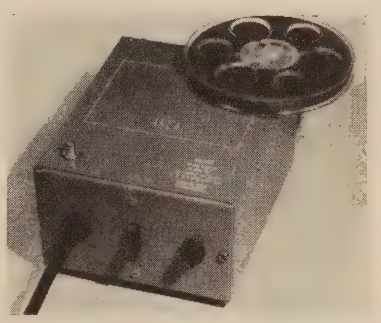
Regulated Power Supplies

PHONO PERFORMANCE can often be improved by using a regulated power supply.

The power available from output tubes is extremely critical of B+ voltage. If the tubes have their maximum voltage applied under quiescent conditions, with no or small signal passing through them, the increased current drain that occurs when full output is required will cause the B+ voltage to drop a little due to the regulation of the average power supply. This will reduce the maximum power output obtainable and also slightly increase distortion of high outputs.

A regulated power supply will provide that additional power and also reduce the distortion at full output

(*Continued on page* 54)



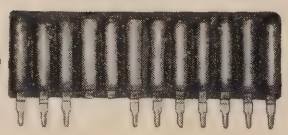
HEAVY-DUTY degausser to erase magnetic tape without the necessity of rewinding. Degaussing removes residual magnetism present on tape as a result of recorded impressions or random magnetism that sometimes occurs during storage. Demagnetization is accomplished by placing tape over spindle provided, and rotating the reel three or four times until every portion of the tape has been exposed to the field area which exists within the rectangle outlined on the top of the degausser. Continuing rotation, the reel is slowly lifted off the spindle to height of approximately 6" to 8" and power is then turned off. (Model 710; Aerovox.)

Supply Volts and Maximum Current	V_1	V_2	V_3	R_1*	R_2*	R_3*	R_4*	R_5	C_1	C_2	E
250 *v* 50 *ma*	6W6	OB2	5Y3	150,000	100,000	15,000	15,000	500—2 *w*	16 Mfd 450 *v*	4 Mfd 450 *v*	300
250 *v* 100 *ma*	6W6	OB2	5Y3	150,000	100 000	22,000	15,000	300—5 *w*	30 Mfd 450 *v*	4 Mfd 500 *v*	350
250 *v* 150 *ma*	6CD6	OB2	5V4	150,000	100,000	18,000	15,000	250—10 *w*	40 Mfd 450 *v*	8 Mfd 500 *v*	325
300 *v* 100 *ma*	6W6	OB2	5Y3	360,000	180,000	27,000	15,000	300—5 *w*	30 Mfd 450 *v*	8 Mfd 600 *v*	375
300 *v* 150 *ma*	6CD6	OB2	5V4	360,000	180,000	27,000	15,000	250—10 *w*	40 Mfd 450 *v*	8 Mfd 600 *v*	375
300 *v* 200 *ma*	Pair 6W6 Parallel	OB2	5V4	360,000	180,000	22,000	15,000	200—10 *w*	60 Mfd 450 *v*	8 Mfd 600 *v*	375
350 *v* 100 *ma*	6W6	OA2	5V4	390,000	270,000	33,000	18,000	300—5 *w*	30 Mfd 450 *v*	8 Mfd 600 *v*	375
350 *v* 150 *ma*	6CD6	OA2	5V4	390,000	270,000	27,000	15,000	250—10 *w*	3 x 16 Mfd 500 *v*	8 Mfd 600 *v*	400
350 *v* 200 *ma*	Pair 6W6 Parallel	OA2	5U4	390,000	270,000	33,000	18,000	200—10 *w*	4 x 16 Mfd 600 *v*	4 Mfd 1000 *v* Oil	475
400 *v* 150 *ma*	6CD6	Pair OB2 Series	5U4	270,000	270,000	27,000	15,000	250—10 *w*	3 x 16 Mfd 600 *v*	4 Mfd 1000 *v* Oil	475
400 *v* 200 *ma*	Pair 6W6 Parallel	Pair OB2 Series	5U4	270,000	270,000	27,000	15,000	200—10 *w*	4 x 16 Mfd 600 *v*	8 Mfd 1000 *v* Oil	500
400 *v* 300 *ma*	Pair 6CD6 Parallel	Pair OB2 Series	Pair 5U4 Parallel	270,000	270,000	27,000	15,000	150—20 *w*	6 x 16 Mfd 600 *v*	4 Mfd 1000 *v* Oil	500

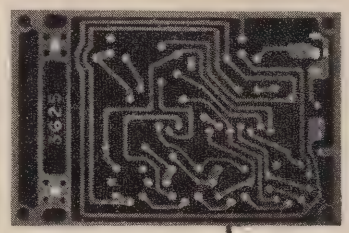
R_1 and R_2 = ½-watt resistors; R_3 and R_4 = 2-watt resistors.

Table 1

A New CONCEPT IN AMPLIFIER KIT Construction



The ERIE
AUDIO-AMPLIFIER KIT



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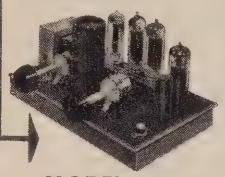
- CAPACITORS
- TONE CONTROL
- TUBES



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- *Frequency Response:* 30 cycles to 12,000 cycles +0, —3.5 db.
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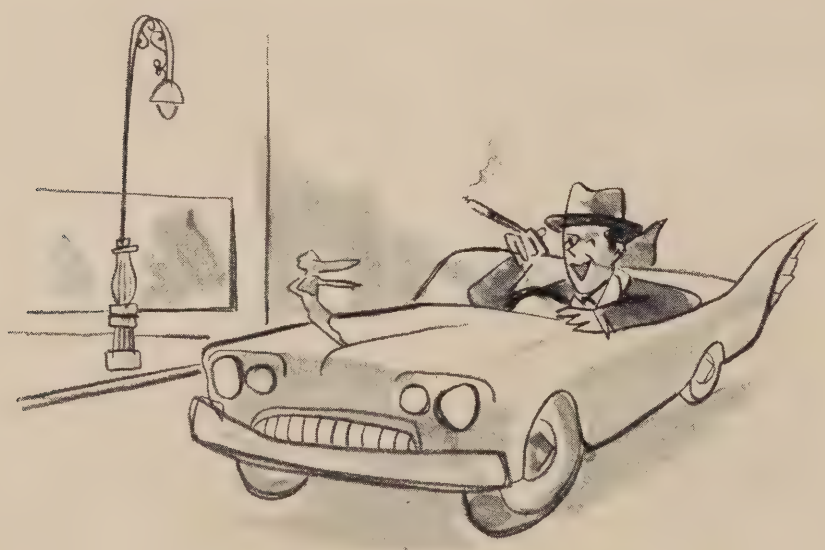


I OWE IT ALL TO THE
RECOTON
"DEALS OF THE YEAR CLUB"

Audio

(*Continued from page* 53)

slightly. The basic circuit for a regulated power supply appears in Fig. 2 (p. 53) and table 1 (p. 53) shows the tubes and circuit values to use for different voltage and current ranges.

Transistor-Radio Audio-Distortion Cures‡

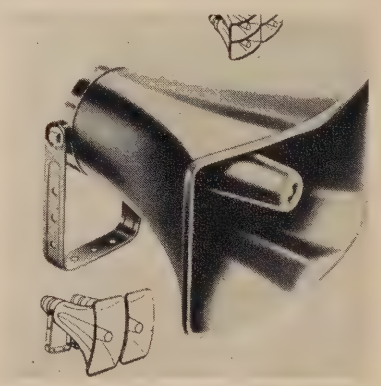
AUDIO DISTORTION troubles of various types can occur in Westinghouse V-2278-1, -2, and -3 transistor-radio chassis.

Servicing to correct audio distortion in transistor radios requires two test instruments which should be standard equipment in every service shop, namely an audio generator with adjustable output level and a 'scope.

Typical Troubles

Audio distortions occurring only at high volume settings on Westinghouse V-2278-1-3 transistor - radio chassis have been found to be due to an unbalance in the class-B audio-output stage.

This can be checked by applying an audio signal (1500 cps, approx) through a .1-mfd capacitor to the collector of the driver transistor. The tuning capacitor should be at maximum capacity and the volume control at minimum. A 'scope should be connected across the speaker terminals. As the audio generator output level is increased, it will be observed that the sine wave is clipped unevenly on positive and negative cycles. In a receiver that is operating properly the sine wave output will be



WIDE - ANGLE public-address projector which incorporates omnidirectional swivel mounting arrangement that enables projector bell to be rotated 360° on its axis. Has an air column length of 4½', horn cutoff of 120 cps and a dispersion of 120° x 60°. (Model CLH; University Loudspeakers, Inc., 80 S. Kensico Ave., White Plains, N. Y.)

clipped evenly on positive and negative cycles.

To cure, one must replace the audio-output transistors with a matched pair.

Audio distortion at both high and low volume settings has also been reported on Westinghouse V-2278-1-3 transistor-radio chassis.

The cause here is an incorrect forward bias between base and emitter on audio-output transistors.

To check this problem, one should connect the audio generator and 'scope as previously.

The volume control should be advanced and the signal-generator output increased; it will be observed that clipping will occur earlier than usual and excessive crossover distortion will appear.

The volume control should be reduced so that the audio is at a very low level and one should listen to the tone with the ear close to the speaker. Even at this very low level the audio will be distorted and raspy.

A voltmeter check will show either no bias or an incorrect bias between emitter and base.

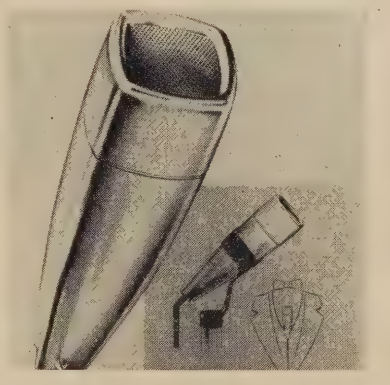
To cure, one should check for possible incorrect resistances (check color coding) of the 10-ohm (thermal runway), 100-ohm (crossover and bias) and the 6800-ohm (center tap to ground; bias) resistors.

The resistance of the 10-ohm, 100-ohm and 6800-ohm resistors should be checked; also the resistance of each section of the driver transformer secondary to ground. Caution: The audio-output transistors must be removed when making these resistance measurements.

———

†*From notes prepared by* ***Jim Martin****, Westinghouse service engineer.*

"What a racket. Every year his weight in JENSEN NEEDLES!"



CRYSTAL MICROPHONE designed for both hand and lavalier use in tape recording and public-address systems. Frequency response is said to be 30-15,000 cps; output level —57 db. (Model M-332; The Astatic Corp., Conneaut, O.)

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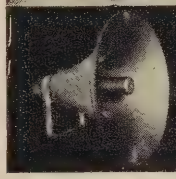

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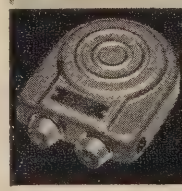

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Miniaturized Circuitry

(*Continued from page* 18)

has been replaced by a transistor amplifier so that a total current gain of about ten results. By increasing the gated input current to 3 *ma*, an output current of 30 *ma* is made available. The purpose of diode D_1 is to prevent transistor saturation and thereby limit pulse stretching. In the enabled condition the gated pulse amplifier consumes about 20 milliwatts of power; in the disabled condition it consumes about one milliwatt.

DC Gates

The gating of flip-flop levels requires a slightly different technique. A schematic of the *dc* "and" gating circuit, which can be used to gate two or more flip-flop outputs is shown in Fig. 11a (p. 18). If a low level appears at any input, the appropriate diode conducts, holding the output low. However, if all inputs are high, the "and" condition is satisfied and the output is high. The *dc* "or" gate is shown in Fig. 11*b*. If any or all of the inputs are high, the appropriate diodes conduct, resulting in a high level at the output. Emitter followers are usually required at the output to reduce loading of the gates.

Flip-Flop Circuit

A diagram of the flip-flop circuit used in computers and control systems appears in Fig. 12 (p. 18). The portion of the circuit indicated by the heavy lines is the familiar Eccles-Jordan configuration. Diodes D_1 and D_2 hold the collector at about .5 volt when the respective transistor is conducting. For alloy, diffusion and surface-barrier transistors, this voltage is ample to hold the transistor out of saturation and thereby eliminate carrier

(*Continued on page* 58)

(1) Computer Control	Vacuum-Tube Multivibrator (*See Fig.* 14)	Vacuum-Tube Cathode Follower (*See Fig.* 15)
(2) Computer Control	Transistor-ized Crystal-Locked Multivibrator (*See Fig.* 14)	Transistor-ized Cathode Follower (*See Fig.* 15)
(3) Television	Sweep Oscillator	.....
(4) Test Equip't	Electronic Switch	Signal Generator Output

TABLE 1: CONTROL AND COMPUTER circuits (1 and 2) and their counterparts in TV and test equipment.

ASSOCIATIONS

NATESA

RUSSELL HARMON has been elected president of the National Alliance of Television and Electronic Service Associations, succeeding *Robert Hester.*

Mac Metoyer was named secretary-general. *Nelson Burns,* was reelected treasurer and *Frank Moch* was reappointed executive director.

Others elected were *Gil Clarke,* eastern vice president, and *Pascal Pratt,* eastern secretary; *Cordell Brett,* eastern-central vice president, and *Marvin Miller,* secretary.

Vincent Lutz and *Joe Driscoll* were elected western central vice president and secretary, respectively.

The new western vice president is *Vinston Haines;* secretary is *Andy Andrews.*

* * *

ETA, Northern Ill.

A NEW ASSOCIATION, Electronics Technicians' Association of Northern Illinois was formed recently in Rockford, Ill. *William R. Mosley,* was named president. *Ray Dumas, Gene Leander* and *Robert Stromeyer* were elected vice presidents.

The group announced that they have a membership of 80, representing about 75 per cent of the Rockford area TV Service Men.

* * *

San Francisco TSG, Calif.

LEN GROSS has been appointed executive secretary, serving as advertising and public relations counsel, for the San Francisco Television Service Guild.

Gross has announced that he is developing an advertising and promotion program to educate the general public concerning the Guild and its members.

The Guild was organized in 1955.

* * *

PRTTA, Pasadena, Calif.

BERNARD H. LINDEN, Los Angeles FCC, recently delivered a talk before the Pasadena (Calif.) Radio Television Technicians Association, on interference problems and the work being done to resolve such problems through the efforts of a Cooperative Interference Committee and the local FCC office.

W. W. Cotie, Hickok Electrical Instrument Co., also appeared before the group and discussed automatic tube checkers.

TEN YEARS AGO IN SERVICE

SPIRALING ACTIVITY in FM, with production of over 1-million sets predicted for the fall and winter of '47, prompted a number of test equipment and component manufacturers to schedule nationwide FM educational programs for distributors, Service Men, and associations. Tuners, converters, tubes, antennas and circuitry were listed for coverage by FM specialists. . . . The FM interest was highlighted by a series of exclusive reports in SERVICE on limiters, FM-AM chassis for custom installations and the latest FM receivers using ratio detectors. . . . The first report on TV wide-band amplifiers also appeared. . . . The board of directors named for the 1948 Radio Parts Show included *J. J. Kahn* and *R. C. Sprague,* representing RMA; *Charles Golenpaul* (parts show president) and *W. W. Jablon,* representing SMCEG; *R. J. Sherwood* and *John L. Robinson,* representing EP and EM; and *W. O. Schoning* and *Aaron Lippman,* representing NEDA. . . . *George C. Isham* was named manager of Sylvania distributor tube sales in the metropolitan division covering eastern N. Y., N. J. and eastern Pa., in addition to his duties as manager of the northeast division.

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The **ADMIRAL** book includes over 1500 Admiral TV models from the earliest sets to the newest 1956 models. Also contains a **PICTURE GUIDE** to TV tube troubles.

RCA GUIDE—No. A1..$1 **ADMIRAL GUIDE—No. M1..$1**

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Miniaturized Circuitry

(*Continued from page 56*)

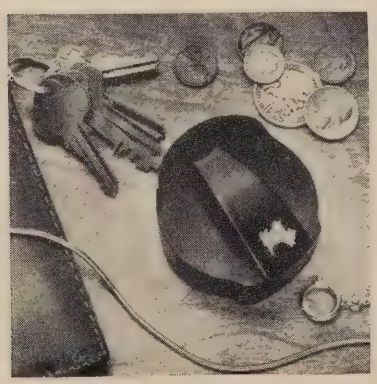
storage effects. The emitter followers T_3 and T_4 act as impedance transformers to isolate the flip-flop transistors from loading effects of the cross-coupling network and external circuits. As a result, switching is rapid, and an output enable voltage is obtained which is nearly equal to V_{cc}. The *pnp* emitter followers T_5 and T_6 are only required when the *dc* "and" gating circuit is being driven. A negative drive current is then supplied by T_5 and T_6 and the load capacitance is discharged by T_3 and T_4. If the load consists only of diode gates, gated pulse amplifiers, or *dc* "or" gating circuits, transistors T_5 and T_6 can be replaced by the diodes indicated by the dotted lines on the schematic. In this case T_3 and T_4 supply the drive currents and the load capacitance is discharged by D_3 and D_4.

The component values for the flip-flop circuit have been chosen so that reliable operation can be obtained between the temperature range of $-55°$ *C* and $+85°$ *C* and at rates in excess of 1 mc. Supply voltages have been chosen to provide the required bias currents and output voltages.

Pulse Amplifier

To supply an output current of about 60 *ma* a pulse amplifier is required. A current of this magnitude is often necessary when a large number of flip-flops and gates must be driven by a single source. The circuit of such an amplifier is shown in Fig. 13; p. 18.

The capacitor C_1 provides a large initial surge of base current which results in a rapid rise of collector current. After the capacitor charges, the drive current is limited by the resistor R_1 such that carrier storage effects are minimized. The discharge of the

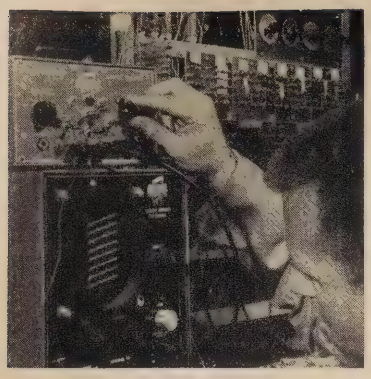


(Left)

TRANSLUCTANCE-TYPE MICROPHONE that includes a two-stage transistorized amplifier built into the same capsule as the microphone unit. Microphone was designed to replace the older carbon button types.

(Right)

ANOTHER MINIATURIZED UNIT, a phone aid, which is a three-transistor amplifier that fits over standard telephone for use in noisy locations, for telephone circuits, and for the hard-of-hearing. (Remler Co., 2101 Bryant St., San Francisco 11, Calif.)



A NEW TRANSISTOR examination technique employing a multi-purpose switching circuit composed of two transistors, which permits quantitative measurements using a calibrated 'scope for rapid design analysis. Technique makes use of a curve tracer. In a typical circuit lab setup, a family of curve of transistor characteristics is displayed on the face of a standard 'scope. Biasing of either npn or pnp transistors is provided for in the curve tracer equipment. (Cubic Corp., 5575 Kearney Villa Road, San Diego 11, Calif.)

TINY TRANSISTORIZED PERSONAL magnetic receiver, about the size of a cigarette lighter, supplied with a miniature mercury storage battery. Operates only within restrictions of a wire loop strung around the perimeter of an area; an entire building can be included in a loop. Can be used for public buildings, such as hospitals, theatres, schools, libraries, etc., where conventional intercom systems are impractical. (Audiopage; Philco Corp., 4700 Wissahickon Ave., Phila., Pa.)

capacitor at the end of the pulse period promotes rapid recovery of the transistor. Most of the power consumed by the pulse amplifier is pulse power.

A tube multivibrator and a miniaturized transistorized version are diagrammed in Fig. 14; p. 18. The circuit in *a* is that of a tube-type multivibrator for generating a square or rectangular wave output at rates up to 100 kc. This unit may be operated free running or it may be synchronized by injecting negative pulses into either grid. Frequency is determined by external timing capacitors and by the *dc* voltage applied to pin 8, the latter providing a method of fine frequency control.

The *b* circuit, a 100-kc square wave oscillator (crystal-locked multivibrator) with two outputs differing by 180°, uses two *npn* switching transistors with *pnp* isolation (emitter-followers) transistors for the outputs.

Two more tube-transistor circuits appear in Fig. 15; p. 18. The *a* circuit is a tube dual cathode-follower for matching impedance levels with an input to the grid and an output at low impedance from the cathode.

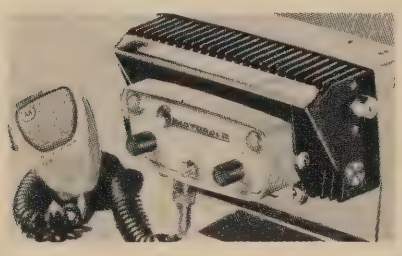
The transistor circuit of *b* also contains two emitter followers in one package.

Commercial and Industrial Uses

An example of the application of printed-wiring boards and transistors is the Transac computer designed by Philco.

In this computer, which uses direct-coupled transistor circuits, all elements required for addition, subtraction, multiplication and division, together with common control circuits, for a binary digit are combined on a

(*Continued on page* 60)



MOBILE TWO-WAY radio units with transistorized power supplies which have finned-radiator heat sinks to conduct heat away from the heat-sensitive germanium power transistors permitting them to operate with adequate factors of safety at extremely high ambient temperature while carrying heavy current loads. (Motorola Inc., 4501 W. Augusta Blvd., Chicago 51.)

TRANSISTORIZED HANDIE-TALKIE radiophone which can be used for inventory control, construction, maintenance and repair, production expediting, and plant protection activities. (Motorola)

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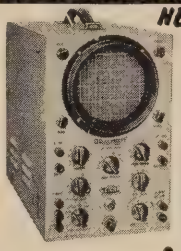

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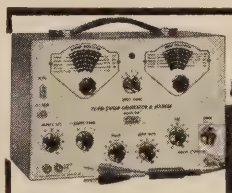
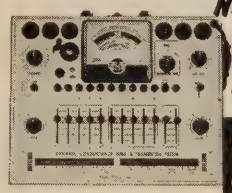
Flat from DC-4.5 mc, usable to 10 mc. VERT. AMPL.: sens. 25 rms mv/in; input Z 3 megs; direct-coupled & push-pull thruout; K-follower coupling bet. stages; 4-step freq-compensated attenuator up to 1000:1. SWEEP: perfectly linear 10 cps-100 kc (ext. cap. for range to 1 cps); pre-set TV V & H positions; auto. sync. ampl. & lim. PLUS: direct or cap. coupling; bal. or unbal. inputs; edge-lit engraved lucite graph screen; dimmer; filter; bezel fits std photo equipt. High intensity trace CRT. 0.06 usec rise time. Push-pull hor. ampl., flat to 400 kc, sens. 0.6 rms mv/in. Built-in volt. calib. Z-axis mod. Sawtooth & 60 cps outputs. Astig. control. Retrace blanking. Phasing control.



NEW TV-FM SWEEP GENERATOR & MARKER

#368 Factory-wired and tested $119.95
Also available as kit $69.95

Entirely electronic sweep circuit (no mechanical devices) with accurately biased incproductor for excellent linearity. Extremely flat RF output; new AGC circuit automatically adjusts osc. for max. output on each band with min. ampl. variations. Exceptional tuning accuracy: edge-lit hairlines eliminate parallax. Swept Osc. Range 3-216 mc in 5 fund. bands. Variable Marker Range 2-75 mc in 3 fund. bands; 60-225 mc on harmonic band. 4.5 mc Xtal Marker Osc., xtal supplied. Ext. Marker provision. Sweep Width 0-3 mc lowest max. deviation to 0-30 mc highest max. dev. 2-way blanking. Narrow range phasing. Attenuators: Marker Size, RF Fine, RF Coarse (4-step decade). Cables: output, 'scope horiz., 'scope vertical.



NEW DYNAMIC CONDUCTANCE Tube & Transistor Tester

#666 Factory-wired and tested $109.95
Also available as kit $69.95

COMPLETE with steel cover and handle.

SPEED, ease, unexcelled accuracy & thoroughness. Tests all receiving tubes (and picture tubes with adapter). Composite indication of Gm, Gp & peak emission. Simultaneous sel. of any 1 of 4 combinations of 3 plate voltages, 3 screen voltages, 3 ranges of continuously variable grid voltage (with 5% accurate pot). New series-string voltages: for 600, 450, 300 ma types. Sensitive 200 ua meter. 5 ranges meter sensitivity (1% shunts & 5% pot). 10 SIX-position lever switches: free-point connection of each tube pin. 10 pushbuttons: rapid insert of any tube element in leakage test circuit & speedy sel. of individual sections of multi-section tubes in merit tests. Direct-reading of inter-element leakage in ohms. New gear-driven rollchart. Checks n-p-n & p-n-p transistors: separate meter readings of collector leakage current & Beta using internal dc power supply.

CRA Adapter $4.50

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FOOLPROOF COIN VAULTMETER

Maximum Coin Security
Shake-Proof
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Simplicity in Mounting
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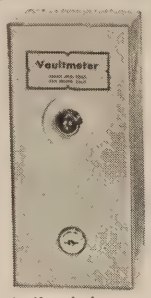
Unique Design



25¢ Coin Meter for automatically timing appliances. Made of 14" gauge steel—all internal parts cadmium plated.

Solves installation problem by having the back panel removable to speed up and simplify mounting. No die cast parts, drive gears, or knobs to wear out. Being 14" gauge steel throughout entire case, makes it as burglar-proof as is possible.

Can be used on all 220-volt model dryers.

Available with 60 or 45 min. clocks—timing cycles may be halved. Timing will service most all automatic washers, dryers, wringer washers, as well as TV programs of 30 min. duration.

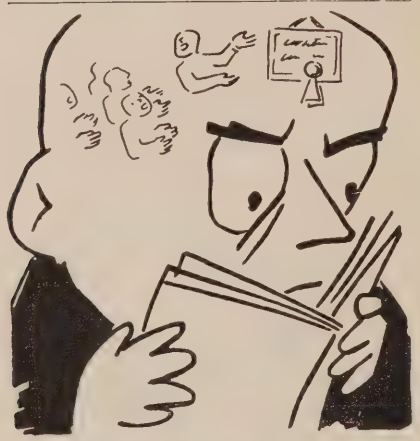
Will automatically throw out any undersized coins by a patented coin arrestor and slot, assuring owners of all monies due them.

Overall dimensions: 3¼" x 8¼".

Model 400 with Coin Vault, list price $26.25
Model 500 with Cash Receptacle only, list price $22.80
Model 700 (available for 72 or 90 minutes) —New Improved Model with Light— with Cash Receptacle only, list price $25.70

Some distributorships still available.

The DEPENDABLE APPLIANCE PARTS CO.
4502 Hough Ave., Cleveland 3, Ohio



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is what you make it. It will be the "best-in-town" if you read CORNELL-DUBILIER'S pocket-size monthly magazine chock full of reputation building service aids. Mailed FREE to your home every month for the asking—just use the coupon below.

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Miniaturized Circuitry

(*Continued from page 59*)

single replaceable unit, a printed wiring card, having on it only transistors and resistors. No other electronic components are required in the arithmetic section of the computer.

The control section of the computer uses cards similar in appearance to the *digit* cards. However, a total of approximately thirteen miniature capacitors along with surface-barrier transistors and resistors are required.

Silicon Rectifiers

Also in the new miniaturized semiconductor circuitry picture are tube based-mounted silicon rectifiers, with some types[1] designed as direct replacements for the 6X4 and 12X4 tubes.

The rectifier features an output of 85 *ma dc* maximum, an input voltage of 400 volts *rms*, and a maximum peak current of 225 *ma*.

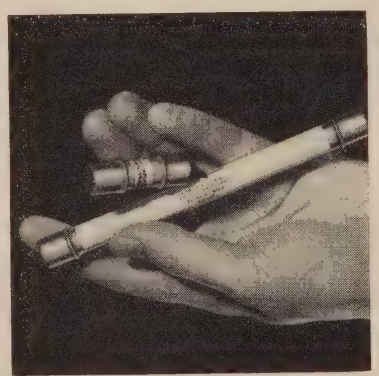
Another new member of the semiconductor family is a 500-*ma* silicon rectifier[2] which employs a silicon diode mounted on a finned heat exchanger for optimum convection cooling.

One rectifier in a half-wave circuit will deliver 500 *ma* and 130 *v dc;* two units in a half-wave voltage doubler circuit will deliver 500 *ma* and 240 *v dc.*

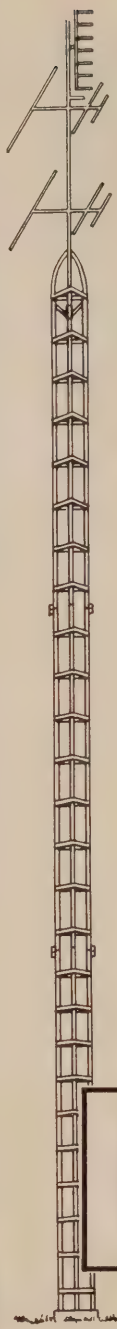
---

[1]*International Rectifier SR-X4.*

[2]*International Rectifier Unistac TU500.*



SILICON DIODE 37/64"-diameter rectifiers, available in four sizes, ranging in length from 1 13/16" to 6 1/16", with ratings from 600 v at 100 ma half-wave dc output to 16,000 v (peak inverse voltage) at 45 ma. (International Rectifier Corp., El Segundo, Calif.)



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WITHOUT A SINGLE GUY WIRE

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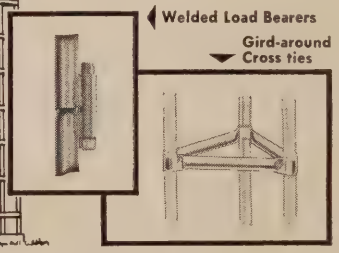
faster installation ... far longer life

- Free standing up to 50 ft.
- Exclusive welded load bearers take all strain off joints — provide free drainage, eliminating trapped moisture and corrosion.
- No bolt holes in structural frame to rust, rip or cause weakness.
- Electro plated with zinc for lasting, lustre finish.
- Easy to install, dismantle, or climb for service.



KTV are the most advanced towers ever designed for residential or commercial use — both in appearance and construction. Tested and proved for greater strength, KTV Towers are available by the 10 ft. section, or in complete kits of 10, 20, 30, 40 and 50 ft. They can be installed on a pitch roof, flat roof, or on the ground. Prices are remarkably low.

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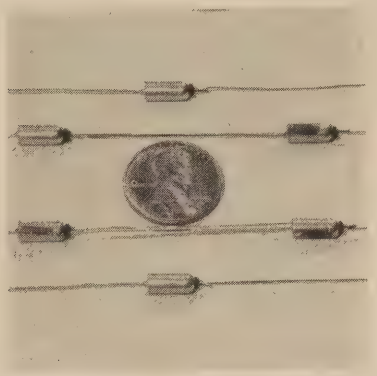
KTV formerly KUEHNE **Tower**

AND COMMUNICATION COMPANY
5520 South Shore Drive, Chicago 37, Ill.

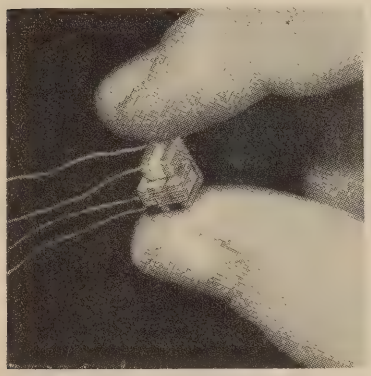
Miniaturized Components . . . Accessories

[See pages 62 and 63 for additional illustrations of miniaturized components.]

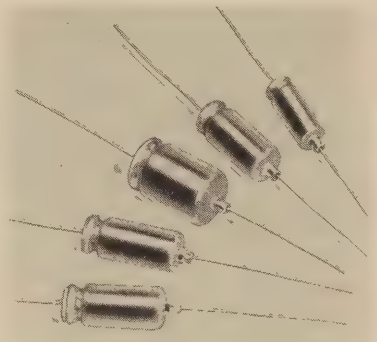
MINIATURE FUSE EXTRACTOR post (1¼" x ¼") for applications where a dead front panel mounting is required, for up to and including 15 amperes at 250 volts. Has a bayonet lock for rapid fuse replacement. (Type 3AG; Littelfuse, Inc., 1865 Miner St., Des Plaines, Ill.)



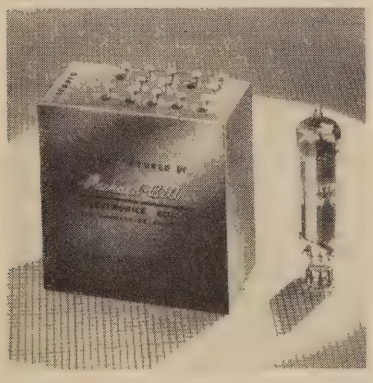
SUBMINIATURE polarized tantalum electrolytic capacitor (occupying only .006 cubic inch volume) designed for use where space is at a premium yet large mfd-volt ratings are required. Available in 8 (50 v dc) to 80 mfd (3 v dc) sizes. (Mallory)



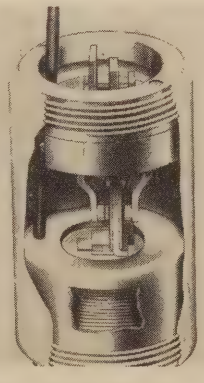
IRON-CORE audio transformer, weighing less than .1 ounce, designed for transistor audio circuits. Fine wire, used for core, is wound on molded nylon bobbins, with special nickel alloy steel used for laminations. (Chicago Standard Transformer Corp., 3501 West Addison St., Chicago 18, Ill.)



SUBMINIATURE aluminum electrolytic capacitors for miniaturized circuitry such as transistor portable radios (pocket and personal sizes), hearing aids, wire recorders and other miniature portable electronic equipment. Aluminum can has silicone rubber hermetic end seal. (Mallory)



DIMINUTIVE TRANSISTORIZED control amplifier (compared to size of ordinary amplifier tube), the heart of voltage regulation for a fire-control system. Output impedance is less than 3 ohms, 0-50 kc; overall circuit gain is 60 to 80 db. (Packard Bell Electronics, 12333 W. Olympic Blvd., Los Angeles 64, Calif.)



VIBRATOR (interruptor, full wave for 6 or 24 v) that is only 1¼" long, ¾" in diameter and weighs 1½ ounces. Primarily designed for short cycle use only. Maximum performance is obtainable under such cycles as 5 to 20 minutes on and ½ to 1 hour off. The vibrator was engineered for applications such as beacons, airborne equipment and other uses where extremely small size and light weight are important factors. (P. R. Mallory and Co., Inc., Indianapolis 6, Ind.)

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Too many *No-Profit* TV Sales and Service Calls Got You Down? Why not investigate the profitable custom-TV market, where there's a big profit on each sale and installation . . . catering to discriminating customers, such as professional men, blue bloods, and the selective leaders of the community. Besides, you can even sell more equipment and service, by providing a whole custom package of TV and hi-fi. Write now, Box No. 9, c/o this magazine, for profit making info.

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Order all four of these time-saving, work-saving XCELITE Pocket Nutdrivers. And, while you're at it, check your needs and order all the XCELITE Tools that will help you do your job better, quicker, more profitably!

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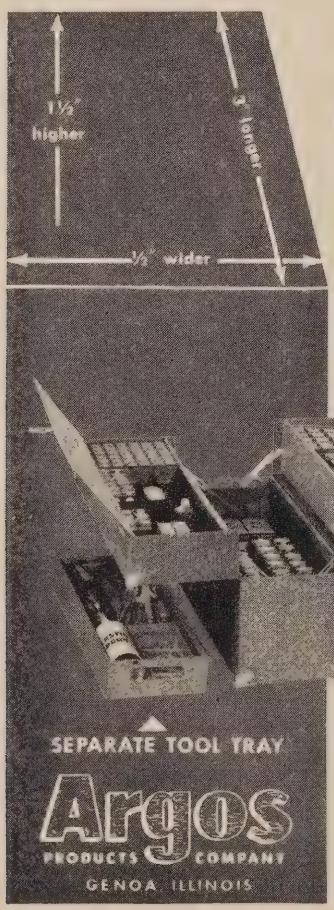

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Biggest mile-saver ever offered. Built for the technician with ability to do more jobs on the spot—who would rather carry a few extra tools than lug a chassis.

Pays for itself quickly in time saved, and in getting more profits for efficient repair work.

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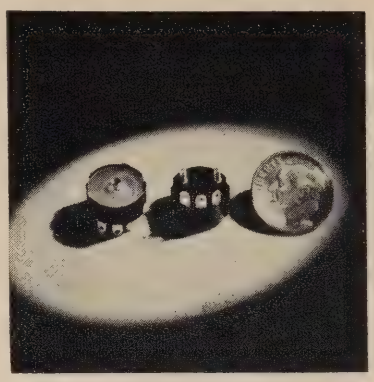
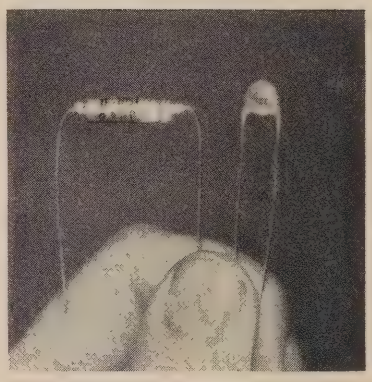
TC-4 —262 tubes max.....$15.95 Net
TC-2A—143 tubes max.....$10.50 Net

Craftsmanship in Cabinets

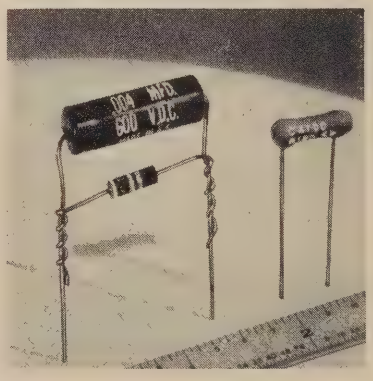
Miniaturized Components



[Above—a]



[Above—b; below—c]



MINIATURIZED - CIRCUITRY compo-nents: At top (a) is a variable resistor, featuring an enclosed on-and-off switch and a wide range of resistance values, designed for transistor hearing aids, miniature radios, telephone equipment and military applications. In center (b) is a miniature ceramic disc capacitor en-gineered for bypass and coupling appli-cations and ideally suited for low voltage use requiring extremely high capacities and low power factors. At bottom (c) is a dual-component unit with a capacitor and a resistor bonded on a single ceramic body. Units, available in standard sizes, lend themselves to many electronic as-semblies, particularly for antenna line applications. (Top to bottom: Mode's 6, Ultra-Kap and Tube-R-Cap; Centralab, 900 East Keefe Ave., Milwaukee 1, Wisc.)

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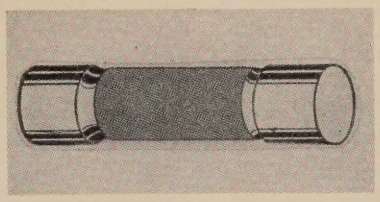
Miniaturized Components

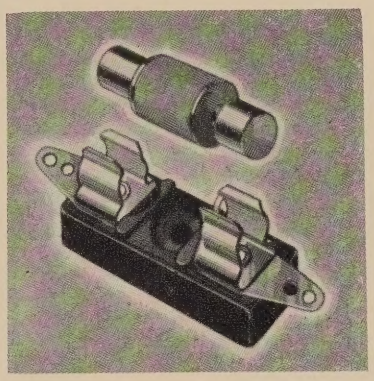


(Above)

SMALL DIMENSION FUSE with a high interrupting capacity for use on circuits capable of delivering currents as high as 68,000 amperes at voltages up to 500. Fuse measures only 13/32" x 1½".

(Below)

MOUNTING BLOCK that automatically polarizes miniature silicon rectifiers. Rectifier is properly polarized by a stop-one clip so positioned that it engages a slot on the positive pole of the rectifier. (Bussmann Manufacturing Co., University at Jefferson, St. Louis 7, Mo.)



(Below)

MINIATURIZED ROTARY - SELECTOR switch for industrial electronic applications, available in current rating ranges of 50 ma (at 300 v ac or dc) to 500 ma (at 30 v ac or dc). (Type BHM; Clarostat Manufacturing Co., Dover, N. H.)

SPARE TIME PROFITS

enjoyed by Radio-TV shops handling small appliance repairs. These jobs picked up on regular service calls and repaired at the shop during slack periods.

For complete catalog RW-58 on Appliance Parts, Switches, Testers, Toaster and Percolator Elements, Supplies, etc., contact your nearest parts jobber. If he cannot supply you, write us giving jobber's name and address.

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Perma-Power UNIVERSAL TV TUBE RESTORER

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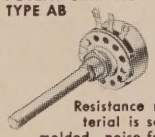
satisfied customers and higher profits for YOU

Industrial electronic servicing is profitable business for you. Especially when you stock and replace with dependable Ohmite components . . . the line your industrial customers know and prefer. With Ohmite you eliminate call backs, insure quality replacement, build customer satisfaction, and increase your industrial (and home) electronic servicing business. Service such industrial equipment as mobile radio, aircraft and marine radar and radio, electronic controls for factory processes and automation, industrial P.A. and intercom systems, and—medical and dental electronics. It's a big market!

BROWN DEVIL® RESISTORS

Vitreous-enameled. In 5, 10, and 20-watt sizes.

MOLDED COMPOSITION POTENTIOMETERS TYPE AB



Resistance material is solid molded, noise-free. Rated at 2 watts.

LITTLE DEVIL® COMPOSITION RESISTORS

Meet all MIL-R-11A requirements. Available in ½, 1, and 2-watt sizes in all standard RETMA values.

Also:

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PRECISION RESISTORS

RELAYS

R.F. CHOKES

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DEPENDABLE RESISTANCE UNITS

OHMITE MANUFACTURING CO.
3642 Howard Street, Skokie, Illinois

PERSONNEL

RICHARD D. KENNEDY has been appointed advertising and sales promotion manager of the receiving tube department, General Electric Co., Owensboro, Ky.

Deutsch

Kennedy

RICHARD DEUTSCH has been promoted to chief sales engineer of Channel Master Corp., Ellenville, N. Y.

* * *

CHARLES GOLENPAUL, Aerovox Corp., has been elected president of the Electronic Industry Show Corp. This is the second time he has held this office, having served as show president in 1948. . . . Other new officers are *Mauro E. Schifino*, Rochester Radio Supply Co., vice president; *Lew W. Howard*, Triad Transformer Corp., secretary, and *Roy S. Laird*, Ohmite Manufacturing Co., treasurer.

Howard

Golenpaul

* * *

PAT CALOBRISI has been named national director of consumer products service of Motorola, Inc., 4545 W. Augusta Blvd., Chicago 51, Ill.

* * *

CLIFFORD SHEARER has been appointed director of marketing of Rek-O-Kut Co., Inc., 38-01 Queens Blvd., Long Island City, N. Y.

* * *

JACK W. MERRITT has been appointed sales manager of the electronic distributor division of Howard W. Sams & Co., Inc., 2201 E. 46th St., Indianapolis 5, Ind. . . . WALTON G. WILSON has been named sales manager of the industrial service division.

* * *

ALBERT COUMONT and KENNETH PRICE have been named regional sales supervisors of Sprague Products Co., North Adams, Mass.

* * *

KENNETH H. BROWN, Westinghouse Electric Corp., has been appointed chairman of the service committee of the Electronic Industries Association (formerly RETMA) for the coming year.

* * *

JOHN P. TAYLOR has been promoted to manager, marketing plans and services, industrial electronic products, RCA, Camden, N. J. . . . HERMAN R. HENKEN is now manager, advertising and sales promotion.

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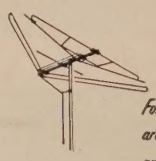

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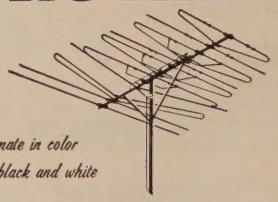

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